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ABSTRACT

A new perspective on the practical problems of changing secondary schools to enhance learning is called "the Copernican Plan" because its implementation would change the schools as completely as Copernicus's ideas changed the perception of our solar system. The plan proposes major restructuring of virtually all the basic systems within a high school, particularly change in schedule. Instead of students changing locations, subjects, and activities seven to nine times each day, they would concentrate on one or two subjects at a time, each subject taught in an extended "macroclass." Integral to the Copernican schedule is a seminar program in which students grapple with the complex issues of today's world. Other features include: a mastery learning system tied to a credit system that substitutes for grades; differentiated diplomas; a conduct and reliable performance graduation requirement; and the "dejuvenilization" of the high school. In addition to a full explanation of the Copernican Plan, chapters discuss the problems that the plan addresses, provide a brief history of the evolution of the American high school, explain why and how the plan works, and offer suggestions for implementation. Appended is an analysis of the use of school time each day and comparison with a traditional schedule. (49 references) (SI)

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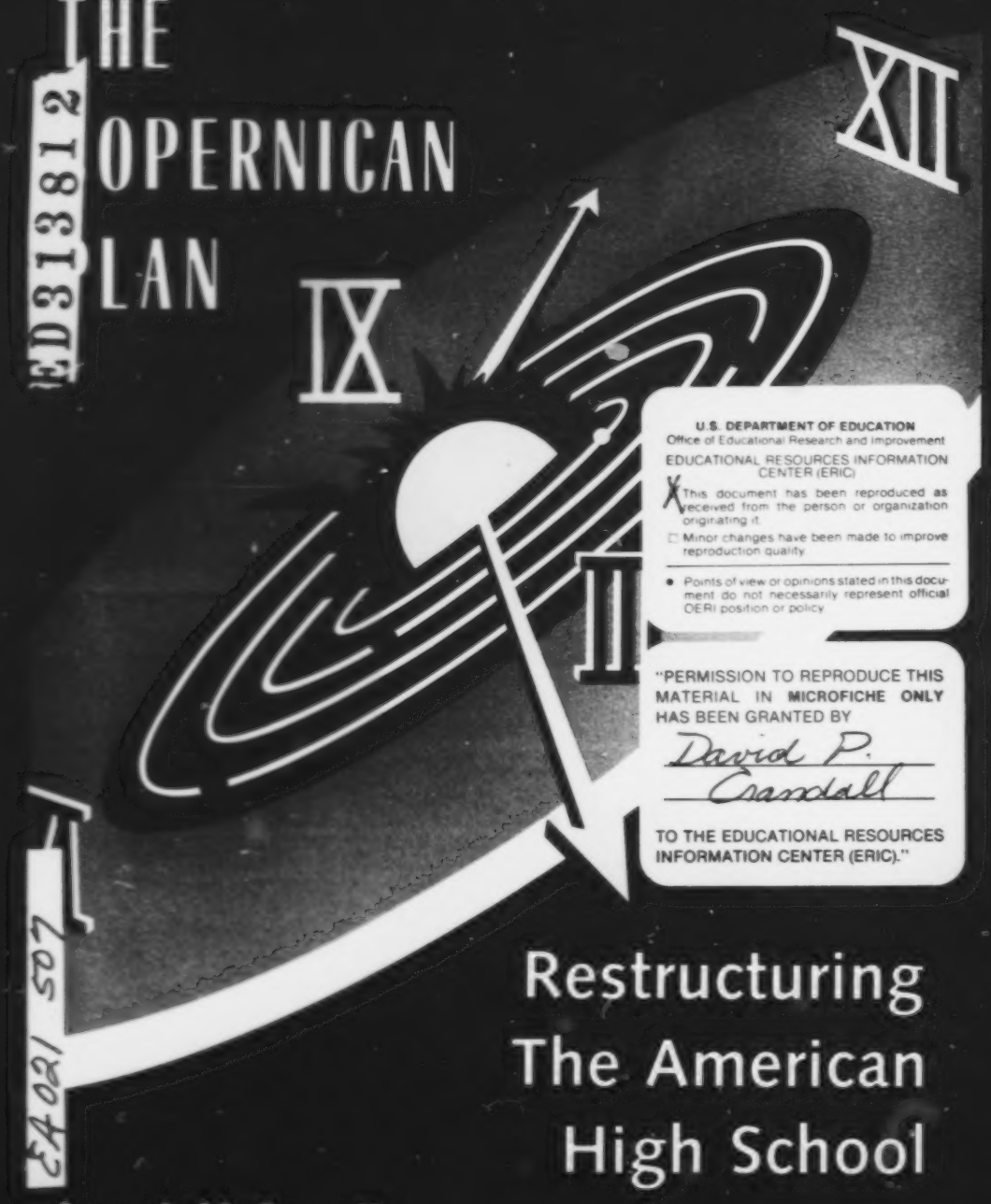

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EA 021 507

Restructuring The American High School

Joseph M. Carroll

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The Regional Laboratory for Educational Improvement of the Northeast & Islands

THE COPERNICAN PLAN

Restructuring the American High School

Joseph M. Carroll

With a Foreword by Harold Howe II,
former U.S. Commissioner of Education

The Regional Laboratory
for Educational Improvement of the Northeast and Islands
Andover, Massachusetts 01810

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Foreword

If the National Commission on Excellence in Education, which prepared the well-known document *A Nation at Risk*, had published Joseph Carroll's *The Copernican Plan* as a companion piece, the school reform movement in the United States would be far ahead of where it is now.

Joe Carroll is a practical educator who has worked in the public schools of Cascade, Montana; Newton, Massachusetts; Westfield, New Jersey; the District of Columbia; Los Alamos, New Mexico; Palm Beach County, Florida; and the Masconomet Regional School District in Massachusetts. He served the last three of these school systems as superintendent. He knows how teachers and principals feel about their jobs, and he knows how taxpayers feel about the schools. He is well read in the literature of recent school reform.

Against this background, Joe Carroll has come up with an important perspective on the practical problems of changing secondary schools to enhance learning and to meet the needs of an increasingly varied student population. He calls it *The Copernican Plan* because its implementation will change the schools as completely as Copernicus's ideas changed the perception of our solar system. He is quite aware that Copernicus's ideas were not well received at first.

In the early to mid-1980s, school reform thinking in the United States was dominated by the assumption that stiffer academic requirements; more standardized testing to assess learning; and more rigid controls of who teaches, how they teach, and how they are paid would bring about the needed improvements in quality. That assumption is now powerfully challenged by two viewpoints: (1) that a

good school must be a friendly place with a climate that builds the confidence of individual students in their capacity to succeed while offering teachers working conditions that support good teaching, and (2) that creating this climate and these teaching conditions will involve what we have come to label the restructuring of the school.

The school reform movement has not totally rejected the prescription of "higher standards" that dominated the early initiatives of governors, state legislatures, and school boards. It has, however, sought new routes to attaining these objectives, and the restructuring of schools is rapidly becoming the most important of these.

Restructuring is a broad concept with no exact definition. It can consist of systems of choice, including vouchers, arrangements to give individual schools more control over their own affairs with the hope of tapping the creativity of teachers, and other changes in the web of governance and policy that control the affairs of schools. Or it can be thought of as applying more explicitly to the internal organization of schools—the routines and assumptions of students, teachers, and principals as they go about their daily affairs.

Joe Carroll's thinking in *The Copernican Plan* provides the individual school with a major source of stimulation for rethinking what it is now doing. Most of the critics and analysts of secondary schools in recent years have been much less specific than Joe about what to do and why to improve the high school, although Theodore Sizer's work is an important exception to this generalization. Carroll and Sizer both get into issues of more imaginative use of school time through altered schedules, smaller classes without major budget increases, and classroom activities that focus on individualized learning and changes in teaching methods.

Joe Carroll, after almost six years of negotiating with his faculty, community, and school board, has launched a pilot program based on the ideas in this publication. It will be worth watching. A group of schools is now experimenting with Ted Sizer's thinking, and though important differences exist between Carroll's and Sizer's conceptions, they largely enrich each other.

As Joe Carroll and his colleagues set sail on a new course, this essay, which rethinks the assumptions of the typical high school with clear logic and a sound sense of reality, can become a useful challenge to any school wishing to start its own voyage of discovery for a better future.

Harold Howe II
Senior Lecturer
Harvard Graduate School of Education

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Acknowledgements

The "self-made" man or woman is probably the victim of a severe case of selective memory. For help and inspiration in the long process of developing *The Copernican Plan*, I am indebted to more people than I can possibly name. One rarely properly credits the importance of encouragement from respected professional colleagues when enmeshed in the slow process of educational change, but here, roughly in chronological order, I'd like to acknowledge some present and former colleagues who have been instrumental in getting this plan off the ground.

Walt Smith, assistant superintendent and superb instructional leader in Los Alamos, developed the summer program that demonstrated the effectiveness of macroscheduled classes. Jerry Williams, who established Palm Beach County's Department of Research and Evaluation, had a quick brilliance combined with a keen sensitivity to the human factor in our work; his input and value went well beyond evaluation and were critically important to developing concepts that are part of *The Copernican Plan*. Jim Maynor, an area superintendent in Palm Beach whose only weakness was his failure to recognize what a good curriculum leader he was, kept the concept of macroscheduling before me at a time I was unable to give it much direct attention.

At a critical moment while I was advancing the Copernican concepts in the Masconomet Regional School District, I received a phone call. A voice said, "This is Ptolemy. I want to speak to Copernicus." It was Harold Howe, who thought *The Copernican Plan* had merit and wanted to help. Ted Sizer, too, indicated that he thought the plan ought to be seriously considered. Roland Barth, then director of the

Harvard Principals' Center, encouraged me by inviting me to join the Center's board.

Dave Seeley, an old friend, sent a copy to Fred Newmann, director of the National Center on Effective Secondary Schools at the University of Wisconsin, who invited me to participate in a symposium on structural change. This gave me the opportunity to learn about what was (and wasn't) happening in schools in places as distant as England and Australia. One of the other presenters, Ian Matthews, head-teacher/headmaster of the experimental Greendown Community School in Swinden, England, and I arranged to exchange teachers. This exchange strengthened my staff's confidence that macroscheduling can work.

Since 1983, the Masconomet Regional School Committee has been superb: They saw the potential of the plan while also considering their communities and the difficulties of implementing something so different. Over six years, they kept the development of a Copernican Plan as one of their objectives as they reviewed, suggested, and criticized constructively. Because of them we were able to launch a pilot project in September 1989.

And I am indebted to the Masconomet teachers, both those who support the Copernican Plan and those who have opposed it. Those who have opposed this new program have done so courteously and professionally. To the extent that we are successful, we will have benefited from their criticism and concern, and they should share the credit. At the risk of omission, five Masconomet educators must be named: Steve Smith, principal of Masconomet Regional High School, and four highly respected teachers, Dave Donaval, Chuck Hodson, Jack Pearlberg, and Vija Skudra. This leadership team has created the pilot program that began this fall. Their task was daunting—it involved at times the entire staff and took most of three years to complete. I am proud of the way they stayed the course.

I also owe a debt to Bayard Waring, who, while serving as the Secretary of Education's regional representative during the Reagan administration, became interested in this plan. In the final stages of planning the pilot program, with funding problems at crisis levels, Bayard found the funds to support an outside evaluation of the pilot program. Since we would not undertake the pilot program without this evaluation, his help was critical.

And last but not least, Janet Angelis of The Regional Laboratory for Educational Improvement of the Northeast and Islands initiated a call expressing the Lab's interest in the plan and suggesting publication. Her excellent insight into how readers will read my "immortal prose" has greatly improved the organization and clarity of this document.

Thanks to all.

Preface

The Copernican Plan did not spring full blown from an excess of zeal evoked by the recent interest in restructuring. Rather, it evolved over the last three decades, a time of increasing recognition that something was seriously wrong with our high schools. Perhaps a brief recounting of that intellectual and administrative odyssey will provide a measure of catharsis for those who share this concern.

The process has been neither logical nor orderly; it has been a frustrating evolutionary experience. It began in the late 1950s and early 1960s with three events: publication of *Images of the Future: A New Approach to the Secondary School*, better known as the Trump Plan (J. Lloyd Trump 1959), which challenged the use of staff and time in our high schools and made me question the status quo and how we deployed staff and students for instruction; reading the studies of the high school by James J. Conant (1959, 1961), president emeritus of Harvard University, which raised concerns about the ability of high schools to serve our national needs; and my becoming Assistant Superintendent for Research, Budget, and Legislation of the District of Columbia Public Schools, which put me in direct contact with a panorama of urban school problems and in a position to analyze them.

My job was concerned primarily with getting the school budget and legislation through the District's congressional committees. In 1965, the District was at last authorized to receive impact aid under Public Law 874, whose purpose is to provide financial relief to school districts that educate the children of parents employed by the federal government. This approval meant that for the first time the local

school board had several million dollars to spend without congressional approval. What to do with these funds? There were many options.

Among the curiosities in the D.C. Public Schools was a regulation that required an elementary student to move on to junior high school at age 13.7, regardless of academic attainment. It was suggested that we use some of our new funds for a summer school program to help these "13.7 students" meet the academic rigors of junior high school. A six-week summer program was organized. Students attended school for about four hours in the morning to study math and reading. Class size was about 20, significantly lower than normal.

With evaluation as one of my responsibilities, I planned a careful pre- and post-testing of these students. The results were astounding. The average student progressed two to three grade levels. Teacher and supervisor reports were very positive. Discussing these results raised some obvious questions. Why couldn't this improvement have happened in the regular school year? What was happening in the summer that didn't happen during the rest of the year? Was it the smaller class size? Was it a better selection of teachers? Was it that these students felt that someone cared about their learning? Did they perhaps learn more in their regular classes than they had demonstrated?

Unfortunately, our follow-up studies showed that most of these students regressed during the next school year. The only results we were sure of were that the least-likely-to-learn students could learn more in less time in the summer class, and that they did not perform well in the regular program. These events raised nagging questions for me about whether schools are organized effectively and whether fewer subjects taught in longer classes over a shorter period would be more effective than the traditional school schedule and year. They reminded me that what is important in education is not how we teach but how students learn—for absolutely nothing has happened in education until it happens to a student.

In 1969, I left the D.C. Public Schools to become superintendent of the Los Alamos, New Mexico, Public Schools. Los Alamos received special funding from the Atomic Energy Commission under a contract that required that the schools be good enough to help the Los Alamos National Laboratory obtain and retain the quality of staff it needed. Good change-of-pace, nonremedial summer programs would help achieve that objective, I thought. So we began offering a variety of regular academic courses for credit in the summer school. The results showed that students could learn chemistry, math, English, or history in classes offered four hours a day, five days a week, for six weeks as well as they learned the same material in 180, 50-minute

class periods. That was a lot less time in class. Moreover, evaluations showed that both students and teachers liked their summer programs and that discipline was not a problem. I began to wonder if this more compact structure would be better for the regular school year. I began calling it "macroscheduling."

But I moved again. I became superintendent of the Palm Beach County Public Schools in Florida, and I had to set macroscheduling aside temporarily. The Palm Beach County Public Schools were in the second year of court-ordered integration. I was the first appointed superintendent—the result of the election of a reform-minded school board and passage of a referendum to change from an elective to an appointed superintendency. With more than 70,000 students and an integration plan to implement, macroscheduling did not get much of my time.

But we dealt with other issues that affected high schools and that later contributed to *The Copernican Plan*. We delved deeply into questions of mastery. We established honors academic and honors vocational diplomas. We also initiated Florida's first minimum competency testing program and made it a requirement for high school graduation. We evaluated rigorously and got impressive results. Honors programs and minimum competency requirements gave students clear objectives. They seemed to provide motivation and concentrate attention.

Then in 1978, I became superintendent of the Masconomet Regional School District in northeastern Massachusetts. At that time the Masconomet district served about 2,000 students in a junior and a senior high school. It is an enjoyable school district in which I had time to think and to plan. When I arrived, Massachusetts had the nation's only fiscally autonomous schools by law, that is, whatever budget the school committee approved had to be raised from local property taxes. But in 1980, passage of a tax limitation measure called Proposition 2 1/2 changed all that. The impact of Proposition 2 1/2 was compounded by rapidly declining enrollments in Masconomet, an experience shared by most of this nation's secondary schools.

We lost about one-sixth of our teachers and most of our staff morale. We faced tough questions: More teachers or lower salaries? Better paid teachers or smaller class sizes? Fewer custodians, more teachers, and dirtier corridors? Fewer administrators or a more effective, caring administration? Eliminate low-enrollment, single-section courses, or increase class sizes in multisection courses? The stress we were feeling at the local level was riding a national tide of criticism of schools in general and high schools in particular. But necessity is the mother of invention.

In the summer of 1982, I began seriously to consider the structure of the high school as it related to macroscheduling, to mastery learning, and to diplomas and what they signify. It came down to two fundamental questions: To what purpose do we educate? How do students learn? The result of my pondering was *The Copernican Plan*, which attempts to address both of these questions. The name was the last addition to the plan. As the following text explains, it seemed conceptually descriptive of what I was attempting to do.

In October 1983, I presented *The Copernican Plan*, by then a 70-page concept paper, to the Masconomet School Committee and my entire staff. Then began a slow process of meeting with departments and parents to discuss the concepts of the plan. All went well until a teacher told me that he liked much of what he read, but that if this plan threatened the jobs of 20 percent of his colleagues, he would have to oppose it. As the text explains, the plan calls for each teacher to teach six classes a year rather than five, thus reducing class size by 20 percent. But simple arithmetic showed that if class sizes were kept as they were, the district could also cut 20 percent of its staff—and the Masconomet staff had been facing reductions every year. With tight budgets and uncertain funding, the school committee was in no position to guarantee jobs. The teachers' association came out strongly against the Copernican concepts as unnecessary, unsound, and unthinkable.

However, several teachers were quietly interested. It seemed possible to think about a pilot program, but these were difficult concepts to pilot. Community reaction was both favorable and unfavorable. There was solid support from most of the school committee that these concepts should be studied, that the objectives were right, and that the Copernican Plan appeared to be one way to reach them. And I received important encouragement from professional colleagues, including Ted Sizer, who was about to publish *Horace's Compromise;* Roland Barth of the Harvard Principals' Center; and former U.S. Commissioner of Education, Harold (Doc) Howe, a lecturer at the Harvard Graduate School of Education. Describing the six years between 1983 and 1989 would require another book. But suffice it to say that a Copernican pilot began in Masconomet High School in September 1989.

If there is a message in this story, it is one of patience, persistence, planning, and politics. That cultural fortress, the American high school, will not change or crumble before lofty concepts or harsh rhetoric. We must marshal all of our professional research and support those educators willing to try promising new structures and methods. Significant change will require political restructuring be-

cause public education is a political process. And we must be prepared to measure progress in years.

I hope you not only find this plan interesting but that you use it to strengthen your high school. If this plan helps in any way, I'll have been amply rewarded.

J.M.C.

Introduction

Virtually every high school in this nation can decrease its average class size by 20 percent; increase its course offerings or number of sections by 20 percent; reduce the total number of students with whom a teacher works each day by 60 to 80 percent; provide students with regularly scheduled seminars dealing with complex issues; establish a flexible, productive instructional environment that allows effective mastery learning as well as other practices recommended by research; get students to master 25 to 30 percent more information in addition to what they learn in the seminars; and do all of this within approximately present levels of funding. How? By redeploying staff and students so that high school teachers can concentrate on teaching students rather than on covering classes. It will not be simple, but it *is* possible. The answer lies in *The Copernican Plan*. But first let's explain that title.

Nicolaus Copernicus' major contribution to 16th century astronomy was his explanation of the movements of the planets. In one sense, his contribution was not original research. Planetary movements had been studied and measured by many others, but their findings presented an erratic pattern that defied logical explanation. The Copernican contribution was one of perspective. If one assumed the sun, rather than the earth, to be the center of the universe, planetary movements could be explained rationally. That simple change became a revolutionary idea. Indeed, the use of the term revolution to mean social upheaval dates from publication of his book, *The Revolution of the Heavenly Orbs* (Bronowski 1973, 197).

Copernicus' theory encountered great resistance. All could see that

the sun rose in the east, set in the west, and thus moved around the earth. More important, that the earth was the center of the universe and that God intended man to dominate the earth had become an article of faith. Copernicus' simple change in perspective was therefore considered both incorrect and dangerous. This Copernican Plan also tries to provide an operational perspective concerning what is known about better instruction. In the process, it challenges some articles of educational faith and frees the American high school from the intellectual bonds of its century-old structure.

The plan proposes major restructuring of virtually all the basic systems within a high school, but the Copernican change is the change in schedule. Instead of students changing locations, subjects, and activities seven to nine times each day, they concentrate on one or two subjects at a time, each taught in an extended "*macro*class." This change allows high school teachers to concentrate on individual student learning—the key to better instruction and improved student performance.

Integral to the Copernican schedule is a seminar program in which students grapple with the complex issues of today's world. Other features include a mastery learning system tied to a credit system that substitutes for grades, differentiated diplomas, a conduct and reliable performance graduation requirement, and the "dejuvenilization" of the high school.

This treatise is at once broad and philosophical and highly structured and detailed. It has a world view of the purpose and role of education, but it never forgets the view from the classroom. In addition to a full explanation of the Copernican Plan, the following chapters discuss the problems that the Plan addresses, provide a brief history of the history and evolution of the American high school, explain why and how the Plan works, and offer suggestions for implementation. Several charts and tables provide detail that will assist anyone wishing to implement the Copernican Plan.

1 The American High School

The mid-1980s found most of this country's high schools facing declining enrollments and sharply limited financial resources. They also shared the problem of responding to the severe criticisms of our nation's secondary schools found in several national reports, including the National Commission on Excellence in Education's *A Nation at Risk* (1983). *The Copernican Plan* proposes a way to radically restructure the American high school so that it can address these issues, but before presenting the details of the plan, it is important to state the basic problems.

Criticisms from Educational Consumers and Colleagues

> *Between the idea and the reality,*
> *Between the motion and the Act,*
> *Falls the Shadow.*
>
> T.S. Eliot, "The Hollow Men"

A shadow has fallen between the idea and the reality of this nation's schools, gathering gradually but persistently until now it threatens the effectiveness of the institution on which almost 90 percent of our young people depend for preparation to become productive citizens. Over the last three decades, criticism of our high schools has mounted steadily. Perhaps this criticism first crystallized in the studies of American high schools conducted by Harvard University President Emeritus, James B. Conant (1959). Conant may be best remembered

for his controversial statement that we were storing up "social dynamite" in our nation's urban high schools (Conant 1961), a prediction that proved to be painfully accurate in the 1960s and is still true today.

But there was concern for all high schools. Criticism grew during the 1960s and 1970s and crested in 1983 with *A Nation At Risk*. The essence of this report is contained in these few sentences:

> Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility. . . . [T]he educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people. . . . If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. . . . The time is long past when America's destiny was assured simply by an abundance of natural resources and inexhaustible human enthusiasm. . . . Knowledge, learning, information, and skilled intelligence are the new raw materials of international commerce. . . . Our concern, however, goes well beyond matters such as industry and commerce. It also includes the intellectual, moral, and spiritual strengths of our people which knit together the very fabric of our society. [I]ndividuals . . . in our society who do not possess the levels of skill, literacy, and training essential to this new era will be effectively disfranchised. . . . (pp. 5–7)

Never in my memory have public school systems been so severely criticized. It is significant that the Commission was authorized to address all levels of education, but the report concentrates on secondary education.

Although many educators embraced the report's harsh criticism, the initial reaction among most ranged from rejection to resistance. But then came a flood of other reports and studies, which, with varying emphasis, confirmed the judgment of the National Commission that our schools, and particularly our high schools, have problems and that the problems are serious and of national proportions. There is now a consensus of concern.

The reports can be divided, roughly, into two groups. The first

generally represents the views of "consumers" of public secondary education. They include reports such as *A Nation At Risk*, *High Schools and the Changing Workplace* (Panel on Secondary School Education for the Changing Workplace 1984), and *Action for Excellence* (Task Force on Education for Economic Growth 1983). Together the panels that prepared these consumer reports represent many distinguished leaders from our corporate world, the scientific and university communities, and our political leadership. The competence and achievements of these leaders command respect. Their identification of the problems of public schools is validated through their combined experience with high school graduates. They are in a position to experience the problems they describe and to assess the impact of inadequate schooling on their respective organizations, on society in general, and on our national life.

The second group comprises distinguished educational leaders and researchers. Among these reports are Theodore Sizer's *Horace's Compromise* (1984), John Goodlad's *A Place Called School* (1984), and Ernest Boyer's *High School* (1983). Professionals such as Sizer, Goodlad, and Boyer also command respect. The consumers are better at identifying problems than solutions, but the educators are better at evaluating the present quality of programs against the quality that can and should be offered.

The litany of these reports, whether by consumer or educator, is at once immensely complimentary and devastatingly critical. They recognize how essential our high schools are to the character and competence of our citizenry, to the quality of our work force, and thus to our future. However, they also forcefully state that high schools are not performing satisfactorily, indeed they are failing us and must be greatly improved. And they refer not only to poor high schools. All high schools must assess their effectiveness, including our good schools. For this is not a demand to return to some mythical basics, to be as good as some think we once were. The reports of these leading citizens and educators ask our high schools to meet a higher standard necessary for national survival in a hostile and competitive world. The question is not how good have our high schools been, but how good can they be? Indeed, the key question is whether they can be good enough.

Declining Enrollments and Limited Funds

At the same time that consumers and colleagues were examining our high schools and reporting their failings, the high school population was declining and "tax" was becoming the political equivalent of a

four-letter word. From southern oil fields to the industrial midwest, from California's Proposition 13 to Massachusetts' Proposition 2 1/2, many people were voting with their pocketbooks. Declining enrollments, coupled with an aging population, eroded the political base in support of public education and made increased funding to improve the quality of education even harder to justify.

In schools, the most obvious and painful impact of declining enrollments and financial problems is reduction of the teaching staff, which damages teacher morale and presents difficult administrative and legal problems. But those twin problems create another less obvious yet more basic educational problem: Smaller enrollments make it more difficult to offer a wide range of subjects or different levels of the same subject.

In general, small high schools are less efficient than large ones. For example, in a four-year high school of 1,200 students, a course selected by only 5 percent of any one class enrolls 15 students (5 percent of 300). If the class declines to 200 students, the same course would have to be offered for only 10 students. Since teachers typically teach five courses a day, the same amount of teacher time and cost is required for the 10 students as was required for the 15. Thus, single-section courses of low enrollment become expensive and difficult to justify and are often dropped. Students whose educations are most affected by the loss of these small classes are the least able and the most able students—those enrolled in the less demanding or remedial sections and those in the honors and advanced placement courses.

One method of maintaining both the breadth and depth of the program is to allow the class size of multisection courses, usually the required basic subjects, to increase so as to maintain the average class size while continuing to offer the smaller, single-section courses; for example, a course enrolling 10 students is offset by one or more enrolling 25 to 30 students. The only other solution is to increase per pupil cost in order to retain the smaller classes and still maintain reasonable class sizes for required courses. But this alternative usually requires substantially more money, and significant additional funding is seldom available.

A Public Dilemma

Today's high schools, then, are confronted with what appears to be an insoluble dilemma. According to the reports, present programs are not satisfactory and the public is placing unprecedented demands on educators to change our high schools. At the same time they demand

that a larger percentage of our citizens complete high school than ever before. Indeed, a dropout rate of zero percent seems to be the new goal.

They're also demanding that high schools graduate young people with a significantly better education, both in breadth and depth, than was achieved by any previous generation of Americans. This improved performance must be accomplished in a climate that reflects a decline of confidence in the high school as an effective institution. This lack of confidence is expressed not just by criticism but by the continuing demand for vouchers and parental choice. Moreover, the political climate is basically hostile to increased taxes, though polls now indicate support for increasing taxes for public education.[1] For support to materialize, taxpayers, whether or not they are parents of public school children, will not only have to understand the need for support but will also have to be convinced that public high schools can improve their performances. They won't send good money after bad.

The only way to significantly improve instruction with approximately the same resources is to become much more efficient. A plan that proposes not only increased *efficiency* but also increased *effectiveness* should have considerable appeal, but it will require major change. Assuming significant efficiencies are possible, can our current schools make the change, or will a new type of institution have to be developed? Perhaps it would be useful to review the American high school's record for change.

Basic Structure

The American high school is an enduring institution. For three-quarters of a century, a period characterized by immense social, political, economic, and technological change, the high school has not changed its basic form of organization. Whether observed in 1920 or 1980, whether in an inner city school in Boston or a small country high school in the West, a common pattern characterizes our high schools.

The school day is usually divided into seven periods, plus a homeroom and lunch period. Classes average approximately 45 minutes, whether the subject is English literature or auto mechanics. The school has a principal and is organized into departments based on academic disciplines. Credit revolves around the Carnegie unit, a 70-year-old system that equates learning with time in class. Lecture, questions and answers, and homework dominate instruction.

The curriculum is designed to "cover" a subject and to make sure the information is presented to students. The responsibility of students is to glean as much information as possible from what is pre-

sented. Those who glean effectively receive As, and those who are less efficient receive lower grades. However, all get the same number of credits, except for those who fail, generally defined as mastering less than 60 percent of the course objectives.

Most students enroll in six subjects each day. In addition, there are activities that make school more palatable to students who are bored by their classes. (A reasonable level of boredom appears acceptable under the not-so-golden rule of "do unto others as they did unto me.") These activities usually center on athletics. At the end of four years, students are supposed to graduate, an event best described as an educational bar mitzvah, a rite of passage between childhood and adulthood.

A rite of passage is tradition, and tradition is self-justifying. Lack of logic notwithstanding, the American high school experience is this nation's most commonly shared experience. It has a subliminally recognized role of trying to pull together this enormously diverse tribe of Americans. High school graduation is a sacrament of our democracy, it is "an outward and visible sign of an inward and spiritual grace." In recent years, the element of grace is less evident. Rigid adherence to a familiar structure is the major contributor to this loss of grace.

Present Plan of Organization

Changes shown experimentally to be superior to traditional methods of teaching are almost never implemented in high schools because improvements in teaching center on the teacher adapting instruction to individual student differences. These more individualized approaches must be superimposed on an existing high school structure that is totally organized around the teaching of full classes, of large groups. This large-group orientation effectively defeats efforts to individualize.

Consider instruction from the viewpoint of the high school teacher and student. High school teachers typically teach five classes a day, each enrolling about 25 students, or about 125 students daily. Usually they teach several subjects, sometimes in more than one discipline. The operational priority is to be prepared to teach those classes every day, and to teach means to cover the curriculum. Dealing with so many students and classes, teachers find that they must teach to the intellectual middle of the class. They try to help the students having the most difficulty and to encourage the best students, but individual contact even with these two groups is limited—and contact with the large middle group is sparse indeed. Ted Sizer's (1984) description of

the frustrations of a typical high school teacher, whom he called Horace Smith, is unfortunately accurate. Horace certainly is alive, but not well, in most classrooms today. This traditional high school instructional environment is the controlling operational reality that in the past has impeded, defied, and survived legislative fiat, school board policy, and administrative efforts to cause the fundamental changes needed for improved results.

Research shows that students learn more efficiently if instruction is highly individualized and material is presented at the frontier of each student's level of understanding (American Educational Research Association 1982; Durden 1987). If students are more successful, success provides incentive, and incentive starts a success spiral that pays instructional dividends and improves attitudes and discipline as well.

Teachers usually want to individualize. University courses and in-service programs tell them it's essential, and elementary teachers have made much progress in this area. But the high school teacher, faced with an overwhelming student load packaged in a procrustean schedule, finds it great in theory but impractical in the real world of high schools. There's a "disaster gap" between the university and the high school classroom, between research and practice, between the idea and the reality.

No significant improvement will occur until high school teachers are provided classroom conditions that foster individualized instruction. High school educators know this. That is why they constantly call for smaller classes, despite class size research that shows that a smaller audience won't improve the lecture. "[S]maller classes produce conditions *necessary, though not sufficient*, for successful teaching and learning" (Bennett 1987, 1). Teachers' requests to have more ability groups are also an attempt to make high school teaching more manageable. Both approaches can be accommodated in the traditional high school, but neither approach changes the requirement of preparing for and teaching five classes and more than 100 students a day.

There have been other attempts to solve the problems created by the high school schedule. During the 1950s and 1960s, a number of school systems experimented with modular scheduling. The basic concept is that on any selected day, certain classes meet for longer periods, and the schedule of other classes is adjusted to accommodate this change. For example, period IV might be extended from 45 to 60 minutes, or perhaps 90 minutes (a double period). However, lengthening one period also requires that other periods be shortened, assuming the total hours per day remain constant. This approach has not worked well enough to be generally accepted, and its major impact has been at the junior high and middle school levels. Often, it would require several additional staff and a computer to keep track of the

schedule. The computer could adjust, but students and teachers, who were faced with several variables, had difficulty in making this kind of day-to-day adaptation. Still, the attempt was recognition by the profession of the rigidity and illogic of the present system.

Another approach, often referred to as individually prescribed instruction, breaks subjects into a sequence of objectives. Each student learns a unit at a time, progressing at his or her own rate from lesson to lesson. The teacher is the facilitator and checks each student's progress. Although I found no information on the current use of this type of instruction in high schools, it appears to have been tried in a few schools in the late 1960s and early 1970s.

Why has individually prescribed instruction since been abandoned? These systems were an attempt to mass produce B.F. Skinner's programmed, highly individualized instructional research (American Educational Research Association 1982) and to impose it on the traditional high school schedule. The students were supposed to be self-paced learners, and teachers were to guide them through the lessons. But in most cases, teachers continued to teach five classes and more than 100 students. Sometimes an aide was provided or teachers taught only four classes, but the results were essentially the same. Such attempts resulted in a record-keeping jungle, too many frustrated and unassisted students, and eventually many burned-out parents, students, and teachers. Although this effort recognized the need to individualize instruction and the research on how to do it, these programs also fell victim to the schedule, impersonality, and rigidity of the traditional high school.

Both of these "solutions" failed to first address the factor that is critical to instruction: the instructional environment for students and teachers. Failed attempts to provide better instruction discourage students, parents, and educators and also discourage attempts to try other alternatives. Yet there *are* other alternatives. The Copernican Plan is one; Ted Sizer's Coalition of Essential Schools is developing some interesting alternatives, including a major conceptual change in organizing curricula; and some states are offering incentives to encourage schools to find totally new ways, including new structures, to reform their schools.

However, if any public school system is to meet the demands for improvement called for in the studies and reports cited earlier, it must consider solutions that target and improve the instructional environment. To get public acceptance, solutions must be consistent with our history and character. Efficiency and concern for the individual are part of our culture. To get efficiency and individualization will require major change. When trying to improve, keep this thought in mind: Though it is possible to change without improving, it is impossible to improve without changing.

2 The Copernican Plan

As discussed in Chapter 1, the present organization of high schools is tied firmly to tradition. The Copernican Plan proposes to reorganize high schools from the viewpoint of effective student learning—more specifically, to use what research and the experience of nontraditional schools teach us about more effective and efficient instruction. This Chapter outlines the major features and advantages of the Copernican Plan: macroscheduling, improved knowledge retention, individualized instruction, interest/issues seminars, requirements for attendance and reasonable conduct, five diplomas, evaluation and credits based on a mastery learning system, mastering more material, individual learning plans, protecting teacher time and workload, making small schools more effective and efficient, and dejuvenilizing the high school climate. Though none of the concepts and proposals discussed here is new to education, the proposal to organize a school so that many of them can be implemented together may be.

Macroscheduling

Copernicus offered a new perspective with which to explain already known facts. The Copernican Plan is predicated on the assumption that if the schedule for students and teachers is completely reoriented to provide conditions that will accommodate better instructional practice, many practices identified with more effective instruction can be implemented. Presently, the typical student enrolls in six classes that meet for approximately 50 minutes each day over a 180-day school year. *The Copernican Plan* proposes that each student enroll in only

one, four-hour class each day for a period of 30 days. Each student enrolls in six of these classes each year, which fulfills the required 180 school days. As an alternative, students could enroll in two, two-hour classes at a time for a trimester of 60 days. A school could schedule both six-week and trimester courses simultaneously, and there can be flexibility in the length of these macroclasses.

Figure 1 shows two possible Copernican schedules. Schedule A shows the plan for six 30-day courses per year; Schedule B, for six macroclasses in three trimesters. As Figure 1 reveals, the Copernican Plan's increased efficiency frees up a block of time that allows the Copernican high school to offer seminars that integrate knowledge across traditional disciplines. The rationale and content of these interest/issues seminars is described below, as are other new features of the Copernican high school—a longer, less frenetic lunch period and a preparation-help-study (PHS) period to close each day.

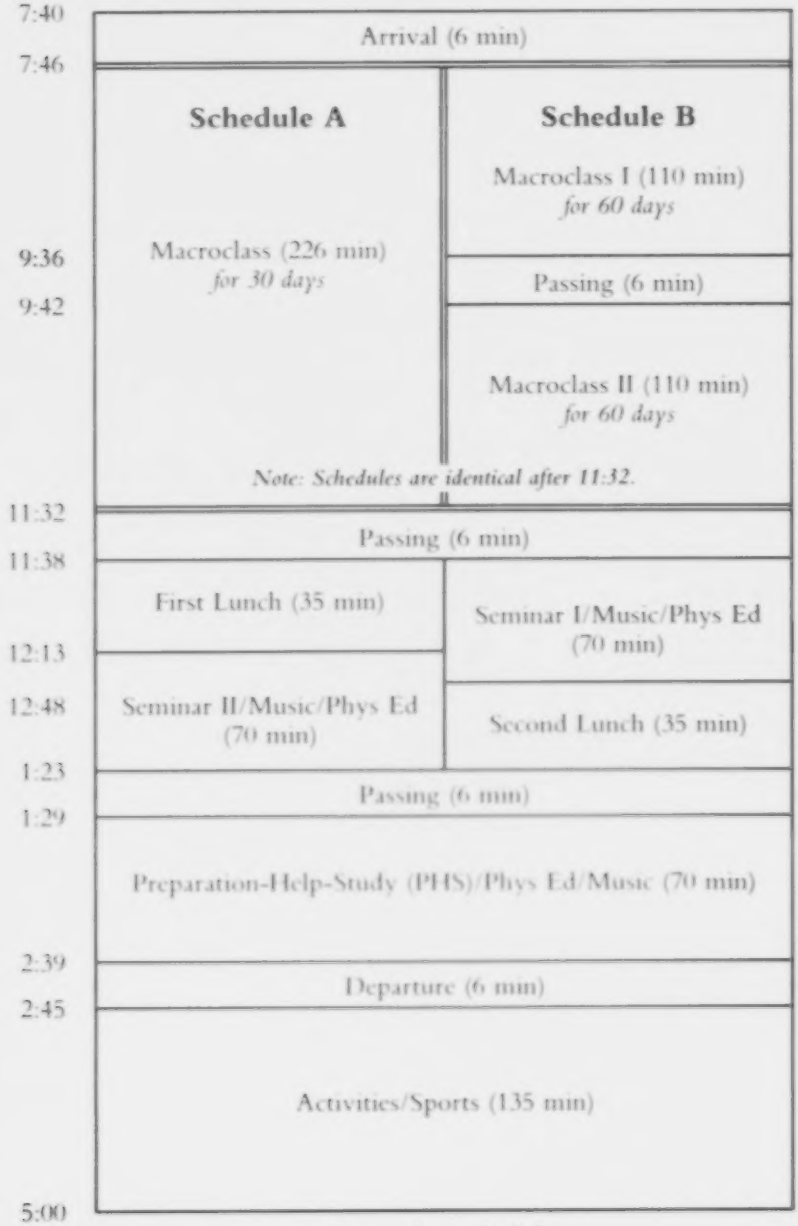
The proposed schedules should not require a longer day or year, and teacher time requirements should not exceed those in a typical school day or year. Negotiated teacher contracts vary considerably, and in some cases negotiations may be required to accommodate the Copernican schedule. However, a basic assumption of the Copernican Plan is to work within the provisions typically negotiated in teacher contracts.

The fundamental question is whether or not students can actually learn as much, or indeed more, in this form of school organization than under the present plan. An understandable response is that students cannot survive a two-hour lecture, much less a four-hour one. And that reaction is a major part of the story. Overuse of the lecture, a large-group instructional method, is a major problem of high school instruction. The Copernican Plan establishes conditions that foster using a variety of more personalized and effective instructional approaches and stresses the importance of providing adequate support for staff to develop these approaches.

As discussed in more detail in Chapter 3, several independent schools use macroscheduling with very satisfactory results (Powell 1976). In addition, High School in the Community, an alternative public school in New Haven, Connecticut, is primarily scheduled in classes of approximately three hours per day, five days per week, for eight weeks. The school has been operating under this schedule for 19 years and sends more than 80 percent of its students on to college.

Nonremedial summer programs employ macroscheduling, too, and typically require students to attend classes for two to four hours a day over six weeks. Summer program experience indicates that students can complete work equivalent to that of a regular high school course,

FIGURE 1



Return bus schedules

with a savings in time of 25 to 30 percent.[2] This experience includes nonremedial, regular high school courses in all major disciplines taken for credit by high school students with normal ranges of ability.

For about 15 years, Johns Hopkins University has been studying the education of gifted students, with particular attention to their learning rates. Typically, junior high school students participating in the Hopkins program complete advanced high school courses in three weeks, spending 75 hours, about half the time allocated to these classes at a typical high school. The courses taught in this schedule include mathematics, science, foreign languages, and humanities (Durden 1987). See Chapter 3 for more information about the Johns Hopkins Program and High School in the Community.

Vocational schools also have successfully used macroscheduling for shop work and related instruction.

The U.S. military, which usually deals with high school graduates having normal ranges of abilities, has had impressive results with programmed instruction in macroscheduled formats. Programmed instruction focuses on a limited amount of material at one time, requires a measurable response, provides immediate feedback, and permits students to respond at their own pace. Results show that test scores of 90 percent or above, a performance level indicating mastery, could be obtained by students in 24 to 50 percent less time than under conventional instruction. This research was based on 150 programmed courses involving hundreds of students (American Educational Research Association 1969).

Some special needs students who have particular difficulty in functioning effectively within the commonly structured secondary school are placed in self-contained, alternative instructional programs that include macroclasses. This may be done when high schools are unable to provide the individual attention that meets their needs in any other way. Often, the students have average or above average academic potential but have emotional or perceptual problems. Experience shows that these students learn more effectively when their teachers can provide individualized attention in a highly structured environment.

In sum, macroschedules have worked well for private school students; gifted students; vocational students; recent high school graduates in military educational programs; college bound, inner-city minority students; high school students who attend academic summer programs; and special needs students. If all these types of students can learn effectively in a macroscheduled class, there is reason to believe that macroscheduling can be effective for every secondary school student. An important fact, found consistently in the evaluations of these programs, is that students actually learn more efficiently without being burned out.

What about the time-on-task research, you might ask. Doesn't it contradict the evidence above? Doesn't more time allocated to a subject guarantee more learning? Probably, if time is used efficiently. However, a review of the research on time-on-task consistently shows tremendous waste in the use of school time. Experts suggest that 40 percent of high school time is not available for instruction, and much of this loss is a product of the schedule (Rosmiller 1985). On one level, the simple reduction in the number of passings from classroom to classroom proposed by the Copernican Plan should reduce the amount of time now lost to the schedule. But since the time considered on task is now fragmented in a classroom environment that impairs effective instruction (Goodlad 1984), the Copernican Plan's greater contribution is that it establishes conditions under which students can engage in learning activities with less disruption.

Improved Knowledge Retention

But will students in a Copernican schedule retain what they learn? Powell's research (1976) found that the "forgetting curve" is sharpest immediately after a course ends and then levels off. Thus a student probably forgets as much over the summer as in the longer breaks of a macroscheduled program. Research on retention indicates that the quality of learning is important to retention. Material learned by rote is not so easily retained as material learned in more meaningful ways. The Copernican schedule allows teachers to develop the kind of immediate reinforcement and teaching strategies that will move what is learned into long-term memory. The concentration of attention and more immediate feedback provide powerful reinforcement, according to Robert Calfee (1981, 20): "The more often we encounter a particular kind of experience, the richer its representation in memory, the more closely two experiences occur in time and space, the greater the likelihood that the arousal of one idea will invoke the other." (A fuller discussion of memory and retention can be found in Chapter 3.)

Perhaps most important, students remember best what they really understand and can apply; memorized abstraction is not remembered much beyond the next test (Powell 1976). *Quality* of instructional time is the critical factor. Let's next consider how the Copernican Plan can facilitate quality instruction.

Individualizing Instruction

The current orientation and organization of secondary education is to teach classes of students rather than individuals. Teachers concentrate

on planning for five classes of approximately 25 students, meeting with as many as 125 students each day. What individualization can occur is usually reserved for those who have fallen behind, and this tends to slow the progress of the class as a group. The major means for individualization is to group students within classes by ability. Teachers are concerned about the ranges of abilities within each class because they want to keep instruction geared to the level of each student's understanding, but they end up teaching to the middle of the class. In whole-group instruction, it is more difficult to teach a class with a broad range of abilities because a greater proportion of students are either lost or bored.

Under the Copernican Plan, a teacher prepares for and teaches either one four-hour class or two two-hour classes. Further, the average class size is reduced by about 20 percent. The reduction in class size is accomplished as follows: Teachers usually teach five classes for the full school year. Under the Copernican Plan, each teacher teaches six classes in a year, increasing the number of classes offered by 20 percent. This results in a 20 percent reduction in class size, assuming the number of classes selected by students remains constant. Also, with 20 percent more sections per year, a school has far more flexibility in grouping students. If classes presently range from 10 to 25 students and average 20, under the Copernican Plan they will range from 8 to 20 and average 16 students.

However, the key advantage, whether the class size is 8 or 20, is that that is the total number of students with whom the teacher deals at any one time, and that is the only class for which the teacher prepares. Even with two two-hour classes for a trimester, a teacher's daily student load drops more than 60 percent. The time the classroom teacher now spends on preparing for five classes can be spent on planning for small groups or even for individual students within a single class, the heart and soul of the more individualized instruction that research and experience indicate is more effective. Teachers teach students rather than cover classes.

There are other advantages. Presently, teachers are not in control of the instructional environment. For example, in assigning homework every teacher must be aware that other teachers are also assigning homework. Homework isn't individualized. High school field trips are disruptive because they take students out of other classes, which creates problems for other teachers. Scheduling outside lectures or combining classes with other teachers for joint presentations seldom occurs because of scheduling problems. Even taking advantage of those "teachable moments" often loses out to the bell schedule. It is not possible to evaluate each student's progress daily; rapid feedback

seldom occurs. Peer teaching is difficult to manage, and teachers don't trust what they can't monitor.

Under either the two- or the four-hour schedule of the Copernican Plan, one or two teachers at a time control each student's instructional environment. Special scheduling is simplified. Virtually all the practices associated with more effective schooling can be carried out more effectively under this type of scheduling. Chapter 3 provides more detail.

Dealing with Complex Issues: Interest/Issues Seminars

A major criticism of American public schools, and in particular high schools, is that students are not given opportunities to deal with complex issues. As a result, there is a serious loss of quality in the instruction provided. This criticism surfaces clearly in most of the national education reports and particularly in those of the National Commission on Excellence in Education (1983), the National Assessment of Educational Progress (1985), and the American Association for the Advancement of Science (1989). Any proposal to improve schools must address this problem.

Educators generally agree with this criticism and want to provide opportunities for students to deal in depth with relevant, more complex problems and issues. The problem is finding the time in a busy school day in which curriculum is organized by academic disciplines. However, the nature of complex issues is essentially interdisciplinary. For example, the question of environmental pollution or nuclear control involves an understanding of science, mathematics, history, civics, government and law, and ethics. Consideration of these issues requires an ability to read, to write, to understand the media, and to speak effectively as either a leader or a participant. A critical limitation is that the time used to consider such issues can result in a teacher not covering the course material. Hence, the consideration of major, complex issues is incidental, tends to be shallow and imbalanced toward a single discipline, and is left largely to chance.

The Copernican Plan proposes to incorporate interest and issues seminars as part of the regular academic program. Under the Plan, the regular academic disciplines and program are accommodated in the morning macroclass(es). On most afternoons, students participate in an interest/issues seminar of approximately 70 minutes and earn I-credits for their participation. The "I" stands for integration, as well as for interest or issues, since the purpose of these seminars is to integrate knowledge and understanding. I-credits are required for

graduation and are awarded on the basis of successful participation rather than on mastery or examinations. Students must be present and participate. For seminars, students are not grouped by ability but by interest. Students can earn more credits by leading a seminar and can receive fewer credits or no credits if their performance is marginal, if they fail to attend, or if they are disruptive.

There should be both interest and issues seminars. However, it is recommended that approximately two-thirds be issues seminars. These seminars can provide a fine opportunity to involve the community directly with students, which would add considerably to the maturity of the school experience as well as foster closer school-community relations and increase the community's knowledge, understanding, and support of its schools.

Seminars should be defined flexibly. The objective is to excite students by offering a variety of topics and ways to become involved. Topics should include political, environmental, social, health, religious, and economic questions of local, state, regional, national, and international dimensions. Participating on a team that is preparing materials for future seminars could be a seminar assignment for teachers and students. Reporting on a foreign exchange experience could be a topic. "Student industries" could be organized as part of the seminars—for example, work-study and volunteer programs, vocational projects like housebuilding, operating an in-school branch bank, or special fund raising activities. An investment club or clubs, with volunteer advisors, could help students learn about our economic system. It might be possible to establish student investment teams to compete within the school and even with those from other schools. Art appreciation and music appreciation could be interest seminars.

The word *unique* can seldom be used because there is little that is new. However, it may be appropriate to use unique in describing this seminar program. It will require a major curriculum development program to plan and prepare a bank of seminars. It will also require a permanent student-parent-staff planning group to identify current issues and develop plans for appropriate seminars.

Requirements for Attendance and Reasonable Conduct

A major complaint about public schools, and particularly secondary schools, is their lack of discipline. Discipline has been listed as one of the most important problems facing schools since the Gallup Poll on Education began in 1969. Poor conduct and incivility are common complaints of educators and are significant concerns presented by

many of the national reports. And study after study has shown that the major reasons for the dismissal of employees are related not to an inability to do their jobs, but an unwillingness to report reliably or to conduct themselves properly. Apparently "will do" is as important as IQ.

In response to those criticisms, educators often complain that they should not have to carry the greater responsibility for the behavior of students; this is the responsibility of their parents. They are right. However, it is clear that most Americans as well as most educators agree that schools must support and demand reasonable conduct. Thus every student should demonstrate good conduct and civility before being graduated from high school. Certainly, for students' future success these qualities are as basic as the ability to read and calculate.

It has been a long-standing practice for schools to evaluate conduct and effort. Some districts deny credit if a student has more than a specified number of unapproved absences from a class. But the problem in withholding credit for unexcused absences is that, in effect, the school tells students that they failed a course because they weren't there enough of the time. Another student who passes may have been ill or on a foreign exchange program and missed more days. Sometimes a student with too many unexcused absences may be able to demonstrate greater competence in the subject than others who receive passing grades. This practice raises legal and logical questions.

One problem with using conduct and attendance to influence academic grades is that the practice is not based on clearly articulated state and local policies and standards. Rather than corrupting an academic grade that should be based strictly on mastery, let's separate conduct and attendance requirements from academic grades. To do so, the local board should write a policy stating that all students must demonstrate an ability to conduct themselves courteously and be reliable in their attendance. Further, the district will not graduate or otherwise recommend a student who has not demonstrated courtesy and reliability as a student.

The administration should establish a system to evaluate conduct and attendance with a minimum level required for graduation. If all teachers as well as guidance and administrative personnel are involved, students and parents will know the conduct rating reflects the opinion of many people. The last year's evaluation probably should be weighted so that improvement in later years can compensate for a poor year, and conversely, initiation of serious problems could significantly affect the student's record and chance for graduation. There should also be ways for students to make up for prior poor conduct —to reinstate themselves—perhaps through volunteer work in the school or community.

Will ethnic and racial minorities be adversely affected by a conduct requirement for graduation? I think not. Whatever stereotyping and discrimination currently exist in schools (and I believe most schools have some) are already reflected in classrooms, in the guidance department, and in the disciplinary system. It is a serious problem that schools should make every effort to address. With training, staff can recognize the subtle nature but devastating effect of cultural or gender bias and take corrective action (Sadker, Sadker and Steindam 1986). By establishing a conduct requirment we will move closer to standards that will be applied to all students, thereby helping to eliminate discrimination in schools. Further, a diploma that became generally accepted as evidence of its holder's reliability could be a powerful weapon in reducing the prejudice faced by many members of minority groups after they leave high school.

As for the dropout rate, I am confident that an instructional program that offers students more individual attention and engaging learning activities will make school a more attractive place in which to remain until graduation. It also might prove to be effective reality therapy. Most students, even those who are often in disciplinary trouble, want their high school diploma. If graduation is clearly dependent on conduct, many students are likely to improve their conduct and act more reliably.

Reducing the dropout rate is a means to an end, not an end in itself. It assumes that students who graduate from high school will be better citizens and more reliable employees than they would be if they dropped out of school. Reducing dropout rates by lowering standards will not solve the problems identified in the national reports. If the high school diploma is to be something other than a "ticket to nowhere," students must understand that developing these qualities is important.

Five Diplomas

Offering the same diploma to all students is the predominant practice of American high schools, each of which establishes a minimum number of course credits for graduation that applies to all students. The Copernican Plan proposes five diplomas: Academic Honors Diploma, Academic Diploma, Occupational Honors Diploma, Standard Diploma, and Completion Diploma. Each student's transcript identifies the diploma received as well as the diplomas available. The official record therefore accurately reflects the accomplishments of each student. Students who wish the more prestigious and demanding di-

ploma must earn more credits, both in terms of mastery credits and I-credits. Graduation requirements and an analysis of the mastery credit system are described in the following sections.

Evaluation Based on Mastery Credits

Americans believe in getting what you earn. Appropriately, schools should develop reward systems based on the premise that you get what you learn. The Copernican Plan proposes to substitute credits that reflect mastery of course objectives for the traditional A through F grading system. This change is a major break with strongly held tradition, and undoubtedly some punster will comment on the "degrading" of American education. But let's examine that tradition from the perspective of how it affects students.

The present educational system is geared to teachers covering a certain amount of material over a certain time. Students must absorb as much information as they can, and teachers must rely on tests and impersonalized systems to assess what students have learned. A student who absorbs information quickly and can demonstrate that on tests, papers, and other assessment measures receives an A and may actually master most of the material presented. Students who receive Bs, Cs, or Ds do not master all the material; however, they receive the same course credits for graduation as those who receive As. And with grade weighting, students who complete advanced courses a year or two earlier than expected receive extra credit points for early maturation rather than greater mastery.

In general, we assume that passing a course means a student has mastered more than half the material, which is usually referred to as 60 percent. What 60 percent represents in art versus what it represents in history is largely up to the teacher. The student who masters 61 percent now gets a D and credit; the student who learns 59 percent gets an F and is required to take the course over or enroll in another. The assumption that the student who failed learned nothing is probably not valid.

There is a tremendous negative impact on students when they fail. As discussed in more detail in Chapter 3, more effective schools employ systems of positive accountability, acceptance of responsibility for learning outcomes, and strategies to avoid nonpromotion of students (MacKenzie 1983). The present grading system simply does not support positive accountability; it is a major contributor to nonpromotion. It also assumes that only A students are excellent, whereas a mastery system supports excellence for all—whatever a student learns is completely and competently learned.

Two problems with the current grading system are the grading curve and cheating. The present organization of secondary schools provides for large-group instruction but insists on individual accountability. Teachers often discourage students from working together. The test is supposed to be a test of each student's performance and is the primary basis for grading. If a student helps too many other students, he or she may "ruin the curve"; a very high performance by one or two students may cause the same result. Thus, in many ways, both direct and indirect, there is pressure for good students not to share and for poor students to cheat to get better grades and meet the competition. Moreover, dealing with large classes and large numbers of students makes it difficult for teachers to work directly and individually with students, so they must rely on less direct evidence of performance. Cheating is often difficult to detect.

The Copernican Plan, with its proposed mastery system and substitution of credits earned for grades, provides many instructional advantages. Among the characteristics of more effective schooling are cooperative activity and group interaction in the classroom, deemphasis on strict ability grouping, and interaction with more accomplished peers (MacKenzie 1983). Under the Copernican Plan, students need not fear the curve. If every student can master every objective, all can get full credit. The need for cheating is also lessened, since students receive all the credits they earn. Further, there is less opportunity to cheat because the teacher, on a one-to-one basis, can assess the quality of performance of each student. Teachers will undoubtedly continue to use tests and quizzes, but they will not depend so much on these instruments since they can work with and observe students directly. And, as discussed in the following two sections, students should master about 25 percent more information under a mastery system.

Credits Based on Mastery of Course Objectives

Because the macroschedules provided by the Copernican Plan allow teachers to concentrate their planning on much smaller numbers of students, it is possible for them to assess accurately the progress each student makes in achieving course objectives. Under the proposed mastery system, teachers must be assured that a student has mastered certain course objectives before awarding a credit. More able students may earn more credits in a course than the less able, but what each student learns is learned well. The teacher certifies mastery.

This mastery system in no way changes the basic objectives of any course now being taught. Algebra I and U.S. History will continue

to be Algebra I and U.S. History in terms of the information and concepts learned. However, the course objectives for each course must be clearly identified and divided into ten approximately equal parts, ten credits. In effect, one-tenth of a full-year course equals one credit.

The basis for awarding credits under the Copernican Plan is as follows:

- Each student enrolls in six macroclasses per year, for a total of 24 in four years. Ten mastery credits equal the credit awarded for successful completion of a full-year, 180–day course under the present system. A student who masters less than 100% of the work receives a proportionate number of credits, e.g., five for mastery of 50% of the course objectives or zero if none of the objectives are mastered.

- Students receive separate I-credits for the interest/issue seminars. These credits are awarded for presence, participation, and attitude rather than mastery and examination. Students receive two credits for successful participation. A teacher may assign an additional credit for leadership or subtract one for marginal performance. Excessive absence or disruptive behavior can result in complete loss of credit. Assuming a seminar meets every other day for six weeks, or 15 days, a total of 48 seminars can be attended in four years.

- Physical education, health education, band, and chorus are scheduled to alternate with either the seminar or the preparation-help-study (PHS) period. However, some music classes, such as composition, can be a macroclass. Credit for physical education and music is also based on mastery of objectives.

- Half-credit courses—physical education, music, and others that currently meet for a single semester or every other day for a full year—can be scheduled several ways and earn 5 credits each. For example, under Schedule A of Figure 1, a macroclass can meet for 15 consecutive days or can alternate with another half-credit course for 30 days. A half-credit course scheduled during either of the 70–minute periods would need to meet 45 times during the year, perhaps on alternate days for half the year. There is considerable flexibility in a macroscheduled school year.

Although credit systems vary from state to state and school to school, the following comparisons between the Copernican Plan and a traditional high school are representative:

- The typical, traditional high school plan provides five credits for a full-year course meeting 46 minutes per day for 180 days. This equals 8,280 minutes per year, or 1,656 minutes per credit (8,280 ÷ 5). Students usually take 5–6 courses per year plus physical education and earn about 110 credits during a four-year high school career.
- The Copernican Plan provides one credit for mastery of each 10 percent of the material now covered in a five-credit, full-year, traditional high school course. In terms of time, this equals 660 minutes per credit (220 minutes per day for 30 days equals 6,600 minutes per each 10 credits if we use Schedule B of Figure 1). Two credits under the Copernican Plan equal one credit under the traditional plan, assuming 100 percent mastery of material in both plans. Thus, a student should master whatever is learned in a traditional course in about 20 percent less time (2 x 660 minutes per 1 credit equals 1,320 minutes, which equals 80 percent of 1,656 minutes).

No component of the current high school compares with the I-credits of the Copernican Plan; I-credits are earned over and above those earned in the traditional disciplinary courses.

Table 1 presents an estimate of the number of credits students probably would earn in four years under the Copernican Plan and converts them into equivalent traditional credits. Estimates are based on students' postsecondary objectives. It is assumed that the more able students will seek the more demanding diploma and, though the courses may also be more demanding, will master a higher proportion of the material.

Mastering More Material

A Nation At Risk (National Commission on Excellence in Education 1983) recommended increasing the school year to 200 days and the school day to seven hours, approximately a 20 percent increase in time. The reason for these recommendations is that students must compete better with students from other industrialized countries, who already attend school 200 or more days a year and have a longer school day. This recommendation assumes continuation of the present level of instructional efficiency. Based on experience with programmed instruction and intensive learning schedules (discussed above and in Chapter 3), it appears possible to increase the actual mastery of course material within the present hours and days if teachers have an opportunity to use more effective teaching strategies.

TABLE 1

Estimated Credits Earned by Students under the Copernican Plan by Type of Diploma and a Comparison of Copernican Credits with the Present Credit System

Type of Diploma	*Number of Credits Earned*									*Total Credits Earned*	
	Macrocourse			PE/Music*			Interest/Issues Seminars*			Copernican Plan	Equiv. to Trad. Credit
	No.	Cred.	Total	No.	Cred.	Total	No.	Cred.	Total		
Academic Honors Diploma	24	9.8	235	6	4.9	29	30	2.3	69	264 plus 69 I-cr	132 plus 69 I-cr
Academic Diploma	24	9.0	216	6	4.5	27	30	2.0	60	243 plus 60 I-cr	122 plus 60 I-cr
Occ. Honors Diploma	24	8.0	192	6	4.0	24	30	2.0	60	216 plus 60 I-cr	108 plus 60 I-cr
Standard Diploma	24	7.5	180	6	3.8	23	30	1.8	54	203 plus 54 I-cr	102 plus 54 I-cr
Completion Diploma	24	6.0	144	6	3.0	18	30	1.5	45	162 plus 45 I-cr (fails to meet min comp)	81 plus 45 I-cr (fails to meet min comp)

*Assumes that students will take six half-credit courses, each requiring 45, 70-minute periods, some of which will be scheduled during the seminar period, as well as 30, 15-day seminars.

Comparing the quantity of instructional material mastered in the Copernican and the traditional high school is difficult. First, the present high school is neither geared to mastery nor evaluated in these terms. Certainly, it is reasonable to assume that an A, B, C, or D represents some difference in levels of mastery, but many questions are unanswered: Is one teacher's A equal to another's? What information should be mastered? Is every instructional objective of equal importance? What are the most important ones? Does an A student master all the objectives? Does an F student learn nothing?

Under a mastery learning system, credit is not given until the spec-

ified objectives have actually been mastered. Table 1 presents the measurement plan and the credit systems under the proposed Copernican Plan and converts these credits into their traditional equivalents. This comparison suggests that every credit earned under the traditional system represents 100 percent mastery of all course objectives; as stated previously, this is not the case. Though an A may represent almost full mastery, lower grades do not. Generally, a D represents mastery of more than half the course objectives, which is popularly conceived to equal and may well approximate about 60 percent of the course.

An analysis of grades at a typical, traditional high school is informative. About 20 percent of the grades are As, and 33 percent are Bs. However, 82 percent of the fine arts grades and 68 percent of the physical education grades are As and Bs. Honors courses have higher average grades than lower level courses. Grading in the subjects of those departments that would be assigned to macroclasses in the Copernican Plan ranges from 42 to 55 percent As and Bs, and 16 to 28 percent Ds and Fs. Assuming that A = 95 percent, B = 85 percent, C = 75 percent, D = 65 percent, and F = 55 percent mastery of

TABLE 2

A Comparison of Copernican Credit with the Present Credit System in Terms of Mastery

Type of Diploma	*The Copernican Plan*	*A Typical Traditional Plan*		Credit Equiv.	Est. Increase in Mastery under Copernican Plan as a Percentage of the Present Plan
	Estimated Total Equiv. Credits (from last column of Table 1)	Est. Total Credits Earned	Est. Actual Mastery Credit %		
Academic Honors	132 Plus 69 I-cr	115	98%	113	17% plus 69 I-cr
Academic	122 plus 60 I-cr	108	90%	97	26% plus 60 I-cr
Occ. Honors	108 plus 60 I-cr	104	80%	83	30% plus 60 I-cr
Standard	102 plus 54 I-cr	95	75%	71	44% plus 54 I-cr
Completion	81 plus 45 I-cr	85	60%	51	59% plus 45 I-cr

TABLE 3

Graduation Requirements

Credit	*Mastery Credit*	*Integration*
Academic Honors Diploma	250	64
Academic Diploma	230	54
Occupational Honors Diploma	205	54
Standard Diploma	190	48
Completion Diploma	Satisfactory attendance and effort in 24 macrocourses plus PE and health. Reliable attendance and attention at all seminars is necessary to earn I-credits.	40

course materials, the average mastery at this traditional high school is about 80 percent. There is no direct research basis for the above percentages, and I found no research comparing grading with mastery, but experience and practice suggest that these are reasonable estimates. Table 2 estimates the degree of mastery that may be achieved under the Copernican Plan with an estimate of mastery earned under the present plan.

Based on this analysis, it appears reasonable to expect approximately 25 percent more mastery of material under the Copernican Plan than under the present plan. My analysis of full-year courses per student in the typical high school consistently indicates an average student completes about 5.5 courses per year, plus physical education. Under a Copernican schedule, all students would complete six courses before lunch and could complete physical education, music, and, perhaps, other appropriate electives in the afternoon. In addition, all the understandings and values gained from the seminars are beyond what is available under the present program. If successfully implemented, the Copernican Plan will meet the objectives of significantly greater mastery of subject matter and awareness of complex issues demanded by the various reports.

Table 3 suggests credit requirements for graduation under the Copernican Plan. Each is established at slightly below the probable number of credits earned as shown in Table 1 and is higher than the 90 credits now required for all students in the traditional high school used for this comparison.

This Plan does not address the composition of credits, but they should differ for each diploma level and should reflect major objectives (science/math/technology, business, or liberal arts) at each level. The Occupational Honors Diploma should also reflect vocational preference. All requirements should be expressed in levels of mastery by discipline.

The Completion Diploma is for any student who does not meet the 190 minimum credit requirements for the Standard Diploma but who completes 24 macrocourses and earns 40 I-credits. The Completion Diploma certifies that the student's attendance and effort were satisfactory and reliable.

Failure to attend, continual disciplinary problems, or evidence of persistent unreliability will prevent a student from receiving any diploma. The Individual Educational Plans of students under Public Law 94-142 should include I-credits, reliable attendance, and reasonable conduct as minimum requirements for graduation. Students who cannot meet these requirements must still have an educational program and continue to work toward improving their performance.

Individualizing Learning Plans

During the past two decades, the educational establishment has become acquainted with the Individual Educational Plan (IEP) as it is used in connection with the implementation of Public Law 94-142. These plans deal with the provision of educational opportunities to students with special needs, as defined under PL 94-142. Although these programs have created some controversy, the best evidence indicates that students with IEPs prosper, primarily because the students, their parents, and their school know what they are trying to achieve and have some basis for measuring progress. The highly individualized characteristic of these plans has made them an important feature in helping these students. In one sense, this is conceptually similar to management by objectives. The objectives are spelled out as precisely as possible, and progress toward achieving these objectives is reviewed and evaluated periodically. These objectives give direction to the efforts of both students and staff.

The Copernican Plan is based on providing highly individualized instruction. It appears appropriate to adapt the IEP as a way of encouraging management by objectives by individual students. Professionally, the high school should try to treat students as clients rather than wards, as individuals with specific interests and objectives that the school should help them achieve. Developing an Individual Learning Plan (ILP) would require greater participation of parents and place

more responsibility on students in developing goals. The primary responsibility for organizing this effort will fall on the guidance department, but in reality, the entire staff will have to assist.

The ILP offers a real opportunity to individualize the diploma. For example, going to college is a general objective. Perhaps a student has an interest in science or mathematics, business or economics, social sciences or the liberal arts, or some combination of these. Students planning to complete their schooling with high school graduation may want to concentrate in a technical or vocational area, human services, or secretarial or office work. The student's educational plan should indicate her or his current target and the appropriate subjects and levels of mastery recommended to achieve that objective.

Students should change their objectives whenever this is desirable. The school must recognize that students are young men and women who are maturing, and their interests and perceptions of their opportunities and abilities are expected to change. The macroschedule, coupled with the reduction or elimination of tracking, should encourage students to adjust their targets and achievement levels—even if in only one or two subject areas—because they will no longer suffer the disruption of having to change tracks and all their other classes. And each student has the opportunity to earn the full 10 credits in every course.

It is also clear that a student who has been seeking a standard diploma may have difficulty in deciding to seek an honors diploma in the middle of his or her senior year. A decision to change an objective in no way removes the student's responsibility to master the necessary course work. However, a review and reassessment of capabilities and objectives should be part of the client experience of each high school student. The high school's basic objective should be to help each student set high, reasonable goals; to understand what will be expected to achieve these goals; and to have a system for reassessing goals against his or her achievements and interests. The Copernican high school establishes much greater opportunity for students to discuss their plans and questions with teachers than is possible in the traditional high school.

The ILP is discussed in more detail in Chapter 4.

Protecting Teacher Time and Workload

The Copernican Plan is designed to establish conditions under which teachers can teach most effectively. A major question is whether the Copernican schedule adds to a teachers' workday or workload. The Appendix presents a detailed comparison of both student and teacher

time allocations under a traditional and a Copernican schedule. Although the traditional schedule appears typical, each high school considering this type of restructuring will have to make its own comparisons. According to the comparison in the Appendix, teacher-student contact time is slightly higher under the Copernican Plan. There is less study hall time, but more extra help time. There is neither corridor duty nor study hall assignments under the Copernican Plan. In sum, the total teacher workday will be approximately 40 minutes less than under the traditional schedule used in this comparison.

A comparison of the typical and the Copernican schedule also shows that several objectives often sought by teachers are attainable under the Copernican Plan. For example, high school teachers are concerned about the number of different preparations their class assignments require, and they often wish to avoid preparations in more than one discipline. Class size is also a concern. Under the Copernican Plan, preparations are reduced to one or two classes at a time. Class sizes should approximate 16 students. Equally important, the total number of students taught each day is vastly reduced.

Preparation time, study halls, and extra help are totally different under the Copernican Plan. The Copernican schedule provides for a PHS period of 70 minutes at the end of each day. Since instruction concentrates on students rather than on classes, the process of helping a student is integral to the teacher's planning process. Since students are concentrating on one or two classes at a time, extra help and a study period can be merged.

The Copernican Plan places much greater control of the total instructional process with the classroom teacher, an objective that teachers have consistently sought. Homework assignments may be tailored to individual students since only one or two teachers are making homework assignments for each student. And coordinating homework is much more easily done if there are only one or two classes. Attendance and much of the "administrivia" that plague teachers can be greatly reduced because teachers keep attendance for only one or two classes and one seminar each day. Teachers can concentrate virtually all of their time on teaching strategies for one subject and on getting to know and understand individual students, how each learns best and is motivated.

Teachers often fret over the increasingly impersonal nature of their job and the frantic climate of the typical school day. The instructional climate should be much more mature, personal, and professional under the Copernican Plan. It appears impossible to truly individualize instruction without personalizing the student-teacher relationship, and

success in imparting knowledge to students is an important factor in teachers' job satisfaction (Schug 1983). Closer working relationships with students should improve teachers' satisfaction, improve teacher motivation, and reduce teacher burnout. And the same should be true for students. In sum, the success of the Copernican Plan depends on developing a far more personal, professional, manageable, and productive instructional environment for teachers.

Making Smaller Schools More Efficient and Effective

A major concern of school districts and of the school community is the problem of retaining present programs when enrollments decline. Further, smaller high schools have difficulty offering a full range of courses, for example, foreign languages and advanced placement courses. As discussed in Chapter 1, when enrollments decline and the number of teachers is reduced, it is particularly difficult to maintain the low-enrollment, single-section courses that are so important to both the less able and the most able students. The Copernican Plan makes it possible to offer 20 percent more sections and thus retain many of these courses, which will let lower-enrollment high schools offer a better program, economically.

Dejuvenilizing the High School

American folklore describes teenagers as hyperactive, frenetic individuals who are difficult to understand. The American high school deals with this hyperactivity by placing the students in a condition of perpetual motion and interrupted attention. Presently, typical high school students are in seven classes, a homeroom, and a cafeteria—or nine different locations—in a six-and-a-half hour day. In addition, if they have physical education, they may have had to change clothes twice and shower once.

Students are encouraged to participate in various activities and sports, which for many occupy an additional two hours during the day; then they are expected to complete their homework, which is supposed to require an additional two to three hours. Well-rounded high school students may be expected to work 12-hour days. Since it is impossible for teachers to coordinate homework assignments, homework can range from very little to an immense amount of work on any particular night. At no other time, either before or after high school, whether at school or at work, is a student placed in such an impersonalized, unproductive, frenetic environment. The question

can be asked if the school is responding to the alleged innate, hyperactive characteristics of teenagers or creating and complicating these characteristics.

If the high school is viewed in historical perspective, the fundamental problem becomes much clearer. Until 1930, most Americans completed their educations at the eighth grade and then went to work. These young people were expected to conduct themselves as young men and women. A saying from our colonial days, "sweet sixteen and never been kissed," comes from a period in our history when most young people had accepted full adult responsibilities by the age of 16. The Jewish Bar Mitzvah, the Christian Confirmation, and various tribal rites that award adult status occur around the age of 12 or 13. During the Great Depression, the American tribe pressured young people to keep off the job market by continuing in school and, in doing so, extended childhood by about four years, seriously weakening our young people's feeling of responsibility for adult performance. As society has become more technological and the nation superindustrialized, the need for more education certainly has been justified. However, it is extremely important that young men and women be placed in a more adult, mature environment and be expected to act accordingly. One of the major objectives of the Copernican Plan is to "dejuvenilize" the high school.

The word *environment* refers to the totality of an experience—physical, organizational, psychological. Virtually every aspect of the Copernican Plan relates to this objective. The organization of the schedule to allow for concentration and more mature and in-depth study of an academic discipline, the mastery system, the development of individual learning plans and the setting of goals and objectives, the ease of scheduling field trips or bringing community resources to the classroom, the recognition that good conduct is basic and necessary for graduation, expanded opportunities for students to work more closely with teachers almost as if they were coaches, and the opportunity to follow interests and to confront issues provided by a regular program of seminars are all intended to provide a significantly more adult, mature, productive, personalized, relevant, and interesting high school experience for each student.

3 Why the Copernican Plan Works

Chapter 2 described in some detail a radically different plan for organizing a high school. Reference was made to many research findings. However, because the success of the Copernican Plan is predicated on establishing a substantially superior and more efficient instructional environment for teachers and their students, it is important to review in more depth a sample of the research that supports this plan. But first, let's briefly consider the status and usefulness of educational research.

Research provides no formula that guarantees a particular level of instructional success to all students, any more than medical research guarantees successful treatment of a particular category of patients. Researchers, quite properly, view their results narrowly and are reluctant to project their usefulness beyond the experimental parameters of the research. But the teacher or administrator, also quite properly, must make decisions based on the weight of evidence. Weight of evidence does not require a specific level of statistical significance; it does require judgment about the meaning of research and the needs of the school to improve.

Education is a practicing, practical, primarily socialized profession. Nearly all students are required by law to be in our classrooms; we had better be ready with a program. If that program is generally accepted by the community and parallels what is done in most neighboring communities, there is scant incentive to change. Thus, the American high school has changed little during the past century. But there is pressure on the high school today. We must decide to stay with the present structure or be guided by research and nontraditional

experience to try to restructure. There is always a risk that change will not result in improvement; there is virtually no risk that adhering to the traditional high school structure will fail to provide the needed improvements, and little risk of a less satisfactory result.

A substantial body of research on teaching and instructional processes has been produced, much of it during the past twenty years. Let's review some of the research to which I have turned in developing the Copernican Plan.

Nontraditional Educational Programs

Several independent high schools have been using macroscheduling for many years. At least one alternative public high school that I am aware of has had many years of experience with this type of scheduling. And there is significant experience with nonremedial summer programs that support macroscheduling as proposed by *The Copernican Plan*.

In 1976, the Education Development Center, Inc. (EDC) of Newton, Massachusetts, completed a study of what it called intensive education programs that had been used by a number of independent schools for many years with very satisfactory results (Powell). EDC's use of the term *intensive education* is essentially equivalent to the term *macroschedule* used in *The Copernican Plan*.

The 29 programs reviewed by EDC varied greatly according to the orientation and objectives of the schools, but three of them, in particular, operate programs that have scheduling characteristics similar to those of the Copernican Plan.

- Fork Union Military Academy in Fork Union, Virginia, has had an intensive program since 1950. Students take a single subject for the equivalent of five periods a day. Each subject is taught for eight weeks. Ninety percent of students go on to college. The curriculum is limited and traditional. There is a short review period at the end of the year for students to concentrate on their weakest subject.

- Gill/St. Bernard's School in Bernardsville, New Jersey, has had an intensive education program since 1971. The classes meet 4 1/2 hours a day for 33 days. A major objective of the school in adopting intensive scheduling was to facilitate use of off-campus resources.

- The Cambridge School in Weston, Massachusetts, instituted an intensive program in 1973. The academic year is divided into

> seven modules of 24 days each. Classes can meet 4 1/2 hours, 3 hours, or 1 1/2 hours a day, and some can run for two modules. Freedom to move classes to off-campus learning opportunities, tailoring the curriculum to each student, and offering a broader curriculum are major advantages. "The program is *not* merely a rearrangement of the calendar or a device to permit doing some things not done before. It is a whole new philosophy, embodying whole new ways of learning" (Powell 1976, 32).

In her study, Powell identifies three critical issues: student learning, teacher role, and human relationships.

Student learning. None of the schools studied adopted intensive learning to increase student achievement. However, many administrators reported that the intensive format "increases student achievement and motivation" and "increases testable knowledge, especially noticeable in languages, math, writing, and reading" (p.12).

Teacher role. Intensive scheduling changes the teacher role from the current "lecture, run discussions, present material all day long" (p.17). According to teachers interviewed, the major differences are diversity in presentation and planning and requiring a more active role of students in learning. They also assess students' progress more deeply and frankly, and the classroom atmosphere is less pressured, with students noting "an understanding between teacher and student. You don't have to constantly be on guard . . . to get a good grade" (p.17). But students and teachers both mentioned the need to be prepared with a variety of activities. Teachers reported an increased awareness of the need to match instructional strategies with individual learning styles. Because they had only one subject to prepare each night, they could concentrate much more of their intellectual energy on individual learning. It is critical that all teachers be prepared to implement this type of program.

Human relationships. The study found that the personal relationships between teachers and students were much closer under intensive education. "Students begin to help each other informally in and out of class. They talk more about what they are studying and see learning more as a collaborative process" (p.19). Problems occur when the "chemistry" of a student and teacher clashes. And there is a risk of an "island mentality" since students and teachers are in contact with only one group and get out of touch with others.

EDC's findings are supported by the experience of other nontradi-

tional programs, primarily summer programs, and in one case, a public alternative high school.

- Johns Hopkins University has conducted many years of distinguished research on the education of gifted students. This research has involved thousands of students in a well-controlled and evaluated summer school program using carefully planned instruction. Typically, gifted junior high students have completed high school courses in mathematics, all the sciences, foreign languages, composition, and the humanities in 75 classroom hours, five hours a day, five days a week, for three weeks, or about 54 percent of the time that would be required of students in a typical high school course. These able junior high students commonly perform in the upper quartile of regular high school students taking these courses under traditional programs. This work is beginning to include some less gifted students and is obtaining similar results, recognizing the students' usual achievement and academic potential (Durden 1987).

- Two 1970 studies found increased achievement for high school students in intensive language courses (Powell 1976). An example of intensive language courses at the secondary level are foreign language immersion programs. Students who have studied their regular academic subject in a foreign language have outperformed monolingual children on many tests (American Educational Research Association 1982).

- Many urban school systems have used remedial summer programs in which intensive programs, usually six weeks in length, concentrate on math and reading. I participated in the administration of one such program in Washington D.C. in the 1960s. On the average, students improved about two grade levels based on pre- and post-tests. Many of these students regressed when they returned to regular school programs.

- From 1970 to 1972, the Los Alamos, New Mexico, school system offered regular classes for credit during the summer. Classes were scheduled four hours a day, five days a week, for six weeks. Instructors used the same curriculum and final examinations that they used for regular year courses. English, math, biology, chemistry, and industrial arts were offered. After the first summer, an evaluation that compared achievement of the summer school students with that of students of comparable ability who had taken the same courses the previous academic year showed comparable performances. Yet classes that met during the academic year had 25 percent more time than the summer program. Reports on atti-

tude and interpersonal relations were very positive for all but one of the summer classes. This class was repeated with more careful planning a year later with satisfactory results.

- High School in the Community, an alternative high school for the New Haven, Connecticut, Public Schools uses an intensive format during the regular academic year. Most of the curriculum is macroscheduled: three hours a day, five days a week, for eight weeks, or a total of 120 hours per course. The program's approximately 200 students are all volunteers; they are about 90 percent minority students, and about 90 percent of them go on to college, including some of the most competitive colleges. Its experience and results parallel those of the independent schools cited above, but with a very different student population.

Learning and Retention

Two major questions about macroscheduling deal with learning and retention. Regarding learning, the question is whether students learn as much in less time in a macroscheduled school as they do in a traditionally scheduled course. The experience of nontraditional schools, presented above, helps us answer this question favorably although it doesn't explain why.

The retention question is more difficult. Will students remember what they have learned in a macroscheduled instructional program as well as they will in a traditionally scheduled high school? More specifically, if students take a course at the beginning of one school year and do not begin the next course in that discipline until the end of the next school year, will they have forgotten significantly more than they would have over the traditional June to September summer vacation? This is a particularly important question for teachers of highly sequential subjects like mathematics. And it is a difficult question to answer since there is little research on learning retention under present programs, much less under a Copernican-like program.

Research indicates that most of what students do not retain is forgotten in the first days and weeks following completion of a course; thus, most of what they are going to forget they lose during a typical summer vacation. The "forgetting curve" levels out over the longer period, for example, the period between macroscheduled classes (Powell 1976).

According to Powell, nontraditional programs have found no problem with retention. She states, "Although students and teachers believe that retention of material improves with concentrated studies,

no one has ever done a serious comparative study of retention under intensive and concurrent schedules" (p. 14). However, she cites one study in which two groups of geometry students, one taught in traditional plans, the other in intensive plans, were compared after a six-month interval. The study found that the mean of the intensive group dropped much more than that of the traditional group. Yet, because the intensive group had a much higher mean than the traditional group, the result was about the same.

While superintendent of the Los Alamos, New Mexico, Public Schools, I conducted a small investigation into retention. Students who completed chemistry in early June were matched with students who completed the same chemistry course under the same teacher in late July in the macroscheduled summer program described above. All students were tested the following March, nine and seven months later, respectively. Interestingly, both groups had forgotten a great deal of what they had learned, which surprised and disappointed their teacher. However, no significant difference in performance of the two groups was found although the summer group had a slightly higher average score. Most important, the macroscheduled students spent about 20 percent less time in class—a result that supports the possibility of a more efficient instructional environment. This result is by no means conclusive though it may be indicative.

Along with several staff members and parents, I presented the question of retention to veteran staff of New Haven's High School in the Community. They reported no problem. Because mathematics is probably the most highly sequential subject and the concern about retention under macroscheduling seems to focus on mathematics, I pursued this question with one of that school's math teachers who had taught many years under both traditional and macroscheduled courses and was considered a strong teacher. She stated that the time for review required to bring a class up to speed presented no problem. In fact, she expressed surprise at the question since it had never been a factor in her experience.

None of the information on nontraditional school programs and learning retention presented above addresses the question of why students should learn more or remember as well or better in a Copernican high school. But there is an answer, and it lies in the research on how people learn, particularly that of behavioral and cognitive psychology.

Learnings from behavioral psychology. The behaviorists, Skinner and others, have identified four basic characteristics of programmed instruction (American Educational Research Association 1969):

1. Focus the student's attention on a limited amount of material at one time.
2. Require a response or answer to each segment of material.
3. Give the student immediate knowledge of results (rapid feedback) after every response.
4. Permit each student to respond at her or his own pace, thereby providing for a degree of individualization of instruction.

Programmed instruction's most impressive results have been achieved under macroscheduled classes, but attempts to mass produce this success under individually prescribed instructional programs in traditionally organized high schools have not been successful (American Educational Research Association 1982). The success of programmed instruction depends on individualization: Each student learning at his or her own rate; each student moving to the next assignment, responding, and getting rapid feedback. The Copernican high school allows teachers to concentrate their time and resources on 60 to 80 percent fewer classes and students at any given time. Teachers have a good chance of following the processes recommended above, whereas teachers in the traditional high school have virtually no chance. That opportunity may explain, in part, the reported success of macroscheduled programs over traditional programs.

Learnings from cognitive psychology. The research of cognitive psychology provides additional insights that may explain the reported success of macroscheduled programs. Calfee (1981) recommends the following principles to guide curriculum design:

1. Any complicated structure must be divided into a relatively small number of chunks to be understood.
2. Each chunk must possess a self-supporting internal coherence.
3. The most effective progression for acquiring a new structure begins with concrete examples, and after the student has become facile at handling a topic, the fullest extent of transfer is achieved by helping the student gain a conscious understanding of the principles.
4. Attaining expertise in any complicated domain happens over time.

The human mind can absorb an immense amount of information, but only if the information is divided into chunks. (A chunk could be mathematics or, at a lower level, how to solve a quadratic equation.) "There must be a scheme for reconstructing the knowledge. The

learner must be engaged with each chunk for a reasonable amount of time, and the learner must experience several variations of the information" (Calfee 1981, 42).

Educators must be concerned with students' short-term memory, long-term memory, and working memory—a somewhat more recent concept. For practical purposes, the capacity of long-term memory appears unlimited, but it is important that students acquire information in a well-organized way. Storing an idea for simple recognition (for example, a multiple-choice test) appears to require only a few seconds of short-term memory, but storage for production, which requires individuals to search for ideas on their own initiative (for example, an essay question), requires about ten times as long. The key lies in how information is presented. "The richness and strength of an idea in long-term memory depend largely on two principles—frequency and contiguity. The more often we encounter a particular kind of experience, the richer its representation in memory; the more closely two experiences occur in time and space, the greater the likelihood the arousal of one idea will evoke the other" (Calfee 1981, 20).

Most important, "a good memory is a better organized memory" (Calfee 1981, 21). Educators speak of learning and retention as separate phenomena, but according to cognitive psychologists that appears not to be so. If a person is presented with well-organized material in conditions that allow for a high level of individual attention, he or she will learn well, and what is learned well goes into long-term memory in an organized manner. As a result, it can be recalled more easily. A Copernican teacher will be able to concentrate on organizing material for individuals and smaller groups of students.

Motivation. A third element in effective instruction is motivation. Responding to students as individuals and providing opportunities to develop self-confidence and self-esteem are critical (National Association of Secondary School Principals 1987). Different students respond to different types of motivation, and a child's background and socioeconomic conditions are major determinants of his or her motivation. What motivates one student may not motivate others. The school structure that allows teachers to work more closely and individually with students should have more motivated students. Improved motivation may explain some of the success reported by the nontraditional programs.

In sum, the Copernican Plan offers an instructional environment that allows and encourages teachers to concentrate on individualizing instruction for students in one, or perhaps two, classes. Instruction should be more efficient, without burnout to teachers or students. I

recognize that changing the schedule does not guarantee that a teacher will move away from large-group teaching techniques to individualize instruction. However, coupled with appropriate inservice training, it will make such teaching much more possible, especially if it is also supported and encouraged by other factors associated with effective schooling.

The Copernican Plan and Factors Associated with Effective Schools

The previous sections dealt with the experience of nontraditional schools and presented some of the research, primarily from psychology, that seems to explain their reported success. Another major body of educational research I have drawn on is the effective schools research, perhaps most commonly associated with Ron Edmonds, Wilbur Brookover, and others (Edmonds 1979; Brookover 1981).[3]

I found Donald MacKenzie's (1983) synthesis and classification of these effective schools characteristics useful in testing the Copernican Plan to see if it would meet criteria identified by the effective schools research as being important to effective schooling. The following sections suggest ways in which the Copernican Plan will positively affect each of 27 factors of effective schooling as classified by MacKenzie, who grouped the factors along three dimensions: leadership, efficacy, and efficiency.

Leadership Dimensions

Positive climate and overall atmosphere. Many factors that affect school climate are not dependent on scheduling systems or the organization of curriculum (for example, reasonable rules that are reasonably enforced, or consistent discipline). The positive potential in the Copernican Plan is that teachers and students work together more closely and for longer periods. This provides more opportunities to discuss rules and the logic justifying them. Class sizes are substantially smaller and instruction personalized, which should positively affect the climate and atmosphere in the school. If the mastery system results in more academic success and fewer failures and if the seminars make school more interesting, the climate will improve substantially.

A negative influence on climate could be created if teachers continue to concentrate on teaching techniques more appropriate to large-group instruction in short class periods (for example, lecture-

centered instruction, question and answer to the whole class with relatively little change of pace, or little or no small-group work or individual projects).

Goal-focused activities toward clear, attainable, and relevant objectives. Rather than objectives for entire classes, the Copernican Plan requires a clear definition of scope and sequence of objectives that each student or group of students is to master in each course. Teachers concentrate on how to group, assign, and assist students in one or two classes to learn most effectively, not on covering the course material with five different classes.

Teacher-directed classroom management and decision making. Although the philosophy of the district and administration of the school determine the teacher's role in classroom management, present student loads and schedule usually do not allow teachers to make the best instructional decisions for the class as a whole, much less for individual students in a class. There is good reason to believe that the traditional high school's organization seriously impairs a teacher's instructional options (Sizer 1984). Under the Copernican Plan, teachers can make some decisions with less concern about their impact on other classes. For example, the Copernican teacher assigns virtually all the students' homework, whereas presently each teacher must consider that five other teachers are also assigning homework. Field trips will not pull students out of other teachers' classes (or only one other class if two macroclasses are used). Teacher independence in instructional decision making will be greatly expanded under the Copernican Plan.

Inservice staff training for effective teaching. A decision to implement the Copernican Plan will require substantial professional development effort.

Initially, every teacher will need an opportunity to study techniques for deploying students and organizing instruction for a period of two to four hours. A major emphasis will be on using the most appropriate instructional techniques and material for different classes, groups, and individual students—for example, students working together on projects or drill; interclass and intraclass academic competitions; maximizing the use of media and instructional equipment; evaluating group and individual student progress in a positive manner to create incentives; cooperative learning; encouraging individual student projects (this should not be limited to only high performing students); planning for cooperative teaching and presentations by teachers who teach the same or related subjects; regrouping students based on

achievement, not only within classes but between classes when appropriate; finding opportunities to show practical applications of classroom material and to have in-depth discussions of various disciplines with teachers and other students; utilizing community resources and field trips.

The development of interest/issues seminars requires extensive work by teachers as well as students and members of the community. Literally every teacher needs to be prepared to lead a seminar group, and there is considerable initial expense in planning, implementation, and evaluation.

Faculty also have to examine the current scope and sequence of courses and more carefully define specific objectives for each student to master.

Initial professional development activities should be part of a long-term plan for continuous professional development—to provide training for new teachers and to allow established teachers to take advantage of the substantially greater instructional options available to them under the Copernican Plan. Building a staff development system should help a district plan, maintain, and evaluate the continuing professional growth of teachers (Loucks-Horsley et al. 1987).

Shared consensus on values and goals. The introduction of the Copernican Plan should be accompanied by a reassessment of values and goals. Indeed, this will be one of the most beneficial but difficult—even painful—parts of the process of change. Questions will be raised. How will the seminar program affect values and goals? How do teachers deal with controversial issues and facts in areas outside their area of expertise when acting as seminar leaders? How will the various publics react? If student reliability and conduct are to be requirements for graduation, what constitutes evidence of reliability and good conduct? What are we expecting of students for each diploma? Are we becoming elitist? What are the common expectations of students? Can a school develop unity within diversity? Is that an objective? These are good questions, and many more will be raised. They will be raised because a Copernican high school is able to address more issues, to raise more questions, and to expect more from its students. In the beginning years, there will be less consensus. However, a new consensus will come as the new structure matures.

Long-range planning and coordination. Implementing the Copernican Plan requires a sophisticated planning process that may need to break out of the traditional one-year-at-a-time budget planning process. It also requires carefully planned program evaluation that is expressed in terms of student progress.

Stability and continuity of key staff. Key staff should be those able to teach most efficiently in a structure that provides a manageable, "coachable," instructional climate. Less able teachers "survive" in the less personal, more routine structure of the traditional 45- to 50-minute period because both students and teachers can go through the motions for 45 minutes. But a mediocre teacher presents a larger problem when students must be with him or her for two or four hours a day. These teachers need more support, and there may well be need for the use of teams to find appropriate instructional roles for them. Teaming and the use of paraprofessionals combined with the development of "lead teachers," as recommended by The (Carnegie) Task Force on Teaching as a Profession (1986), will strengthen stability and continuity of key staff. Teaming should allow these staff to use a wide range of instructional approaches and all of their professional knowledge. And key staff will have different leadership roles, which can justify the salaries necessary to recruit and retain them.

District-level support for school improvement. Clearly, district-level support must be strong and steadfast if a high school plans to implement a Copernican program. The school board and representatives of parent groups must be part of the process from the beginning. No responsible school board or parent group will approve this level of change on short notice and faith—nor should they be asked to do so. Without district support for more than customary variations of the present program, individual schools cannot be restructured. The key to major restructuring rests with those who control policy, funding, and personnel; today, that remains the superintendent and school board.

Efficacy Dimensions

High and positive achievement expectations with a constant press for excellence. A number of the national reports on school reform (Sizer 1984; Goodlad 1984) propose development of mastery learning. The Copernican Plan proposes a mastery system supported by Individual Learning Plans (ILPs) for all students. Many state legislators, state departments of education, and local school boards have already increased required courses and raised standards. But it's much easier to raise the bar than it is to get students to jump higher. The Copernican Plan concentrates on the teacher-student relationship and workloads and restructures the use of time to create a more efficient, personalized instructional environment. It proposes a way to help students jump higher, increasing their academic success while decreasing their chance of failure and bolstering self-esteem.

Visible rewards for academic excellence and growth. The Copernican Plan's ILP, mastery system, and multiple diplomas (including vocational honors diplomas) tie rewards more closely to performance and provide more immediate recognition of growth than is possible in a traditional high school. Eliminating A to F grading and instituting the mastery credit system of rewards for achievement is a significant step in emphasizing excellence and relating performance to rewards. In addition, the Copernican Plan emphasizes more frequent, even daily, assessment of progress between the teacher and the student as objectives are mastered. The actual number and level of mastery is the reporting system.

Cooperative activity and group interaction in the classroom. Evaluations of cooperative learning programs in which students work together or one student tutors others have been consistently positive (Newmann and Thompson 1987; Walberg 1984). The Copernican Plan encourages cooperation and group interaction. Each student benefits from what she or he masters, and if one student learns from another, so much the better. If every student masters every objective in the course, all get full credit, and that's fair. The closer relationships between students and teachers over a period of two to four hours make it relatively easy to organize students for cooperative activities, to allow students to work together within the classroom, and then to determine what is learned by each student.

Total staff involvement with school improvement. The total involvement of staff in school improvement is well established as a factor in successful change (Loucks-Horsley and Hergert 1985). Change such as that proposed in the Copernican Plan requires intense faculty involvement, and there is certain to be division in the faculty. However, the more staff members who are involved, the less resistance to change.

Autonomy and flexibility to implement adaptive practices. The Copernican Plan should not affect the autonomy of teachers. But given the same levels of administrative support and freedom, it provides significantly more opportunities for teachers to adopt and adapt effective new instructional practices than does the traditional high school.

Appropriate levels of difficulty for learning tasks. A major advantage of the Copernican Plan is that it allows teachers the opportunity to maintain appropriate levels of difficulty for each student or group of

students within the class. In addition to teachers' own daily assessments of individual student's ability and progress, they are guided by each student's ILP, which quantifies learning goals for that individual. Moreover, with 20 percent more sections, grouping by ability and interest can be done much more effectively.

Teacher empathy, rapport, and personal interaction with students. Most high school teachers have a genuine interest in students, and over the years, many teachers develop good relationships with students. I have observed that at most secondary schools, a much higher percentage of those teachers who coach or sponsor extracurricular activities develop rapport with individual students than do other teachers. The adverse impact of the impersonality of the present high school is not limited to students; it affects many teachers as well. One of the potential advantages in the Copernican high school is that over periods of six or twelve weeks (the latter about the length of many athletic seasons), a teacher will have regular and in-depth contact with a small group of students.

Further, in the interest/issues seminars, teachers meet students in a more informal, collegial environment, and students see teachers as people with common concerns. With a deemphasis on formal grades and an emphasis on participation, it's possible for students to work *with* rather than *for* teachers in studying problems. This experience should provide opportunities for teachers to be seen not only as authority figures but also as interesting persons, as persons who share some concerns with students, are interested in students, and are still seeking knowledge and learning.

Emphasis on homework and study. The Copernican Plan leaves control of homework completely with one or two teachers at a time. Assignments related to the interest/issues seminars are relatively light, informal, and voluntary; and because of scheduling, seminar assignments are never due the day after they are accepted. With the higher degree of individualization, homework assignments that are appropriate and demanding can be given to each student and can be graded daily. Graded homework is much more effective than ungraded homework (Walberg 1984). Moreover, independent study projects can be more easily developed and monitored. The issue of fairness in assigning different homework or projects to different groups of students is under control because students who master a greater portion of the subject matter receive proportionally more credits.

Positive accountability, acceptance of responsibility for learning outcomes. Under the Copernican Plan, teachers are accountable for a student's mastery of the curriculum in only one or two classes at a time, for an awareness of each student's progress, and for adapting instruction to each student's progress and problems. Mastering subject matter places a greater responsibility on the student, cheating is much more difficult, and accountability more continuous and precise.

Strategies to avoid nonpromotion of students. In a Copernican school, a student who masters less than 60 percent of the course material will earn less than six of a possible ten credits but will not fail and receive no credit (unless none of the course objectives are mastered). Though two or three credits may not be inspiring, they are part of a positive approach that is inherently fairer, less damaging to self-esteem, and more realistic than the present system, which offers the same number of course credits to students who score between 60 and 100 percent, while giving a student who scores 59 percent absolutely no credit. Failure can also be reduced by offering a more varied curriculum. When faced with declining enrollments and increasing financial limitations, offering courses at several performance levels becomes increasingly difficult. The Copernican Plan allows 20 percent more courses to be offered, which allows the school to offer more courses and to better reflect interests and performance levels than is possible under the present system.

I do not recommend, and will not propose, automatic passing of students regardless of performance. However, it's more effective and efficient as well as humane to teach the student well once rather than poorly twice. Failure wastes school resources as well as student time.

Deemphasis of strict ability grouping, interaction with more accomplished peers. Although there is little chance of individualizing in the traditional high school, there is an excellent chance to group heterogeneously under the Copernican Plan. With 20 percent more sections, a school that wishes to increase or maintain homogeneity of offerings can do so. However, because of the ability of teachers to regroup and individualize within each macroclass, the need for tracking and homogeneity is reduced. Greater heterogeneity can be allowed because each student or group of students within a class can be challenged at appropriate levels of difficulty (Slavin 1981). Without tracking and with the opportunity to earn all 10 available credits, students have a chance to shine in as many classes (or seminars) as they are capable of or inclined to; the ceilings are removed.

Efficiency Dimensions

Effective use of instructional time, amount and intensity of engagement in school learning. The comparison of the allocation and use of time under the present system and the Copernican Plan is analyzed in Chapters 2 and 4, as well as the Appendix. Time-on-task is concerned with how well time is used in the classroom. Under the present system, several minutes are required to settle the class, to take enrollment, and to shift students' thinking from the last class to the present. Substantially reducing time loss due to setting up and closing out and removing the need to shift gears so often during the day are significant advantages of the Copernican Plan. Too often, a student has worked through a concept or process and things are beginning to fall in place—and suddenly it's time to go to another class. Similarly, a teacher may need more time to develop a concept, but the bell rings. Short class periods often prevent intensity of engagement—deeper discussion, exploring questions in greater detail, and relating class work to current problems and other disciplines. Improvement in this factor is one of the major strengths of the Copernican Plan.

Orderly and disciplined school and classroom environments. Dejuvenilizing the high school is a major objective of the Copernican Plan. It defines learning more as a job, a major assignment. Mastery of course material assumes fully competent performance of every objective. If one student learns more and gets more credits, fine. As in life, excellence—mastery at whatever a student chooses to study—is emphasized. Competent plumbers are more respected than incompetent doctors. Under the Copernican Plan, students have a workplace for a six- or twelve-week period. The macroclasses should not be monolithic and quiet—mostly lecture and isolated effort. Students can work together or separately. The target is learning, mastery at whatever level of difficulty, rather than beating the curve for an A. Although there are other activities, particularly in the afternoon, students have only one or two major assignments at one time. Sports are maintained, and indeed, participation in athletics is encouraged under this plan (see Chapter 4). But the balance between athletics and academics will be better. The interest/issues seminars are designed to raise adult questions and to provoke mature thought. They should build character and help create concerned citizens. The Copernican Plan will provide a more mature, orderly, and productive climate that will result in more successful students, and success is the best way to prevent disciplinary problems.

Continuous diagnosis, evaluation, and feedback. The present system allows students to go for many days, possibly weeks, before they get

clear feedback on their performance. With a small number of students on which to concentrate, teachers in the Copernican high school provide frequent, perhaps daily, assessments of progress. In addition, assessment can be based on more than paper and pencil tests—for example, individual projects or oral presentations. The Copernican high school has a major advantage over the traditional high school in this factor.

Well-structured classroom activity. The quality of classroom activity depends primarily on the teacher. Most teachers currently maintain well-structured classroom activities dominated by work with the whole class. The Copernican Plan emphasizes concentrated work with smaller classes and with subgroups and individuals in the class. If teachers can adapt to a different form of organization and maintain a well-structured series of classroom activities for each student within a single class over a longer time, the plan will work. The experience with macroclasses, discussed in more detail earlier in this chapter, indicates that they can.

Instruction guided by content coverage. In traditional high schools, the curriculum is generally defined, and instruction to the class is guided, by content coverage; the most effective teachers modulate instruction based on the progress made by the majority of students. The Copernican Plan, however, is guided by content mastery by individuals and small groups of students.

Schoolwide emphasis on basic and higher-order skills. The Copernican Plan emphasizes both basic and higher-order skills, which involve applying knowledge to problems and mastering more complex concepts. The Copernican Plan offers much greater opportunity for development of higher-order skills, both in regular classroom instruction and through the interest/issues seminars. The mastery system stresses the acquisition of skills basic to each course.

Opportunities for individualized work. The Copernican Plan provides time and flexibility to encourage all students, not just the most capable, to undertake individual projects. Projects can capitalize on student interests and offer the motivation necessary for improved overall mastery of the subject matter. For higher performing students, projects can increase the challenge in a course. Credits might be given for projects that demonstrate mastery of course objectives or that go beyond the course curriculum. Again, the Copernican Plan has an advantage over the traditional high school in providing opportunities for individualized work.

Number and variety of opportunities to learn. In the traditional high school, each teacher teaches five classes so that the total number of sections that can be offered is five times the number of teachers. Under the Copernican Plan, it is six times the number of teachers, or 20 percent higher, giving the school the opportunity to provide more offerings. With the interest/issues seminars emphasizing a more informal, far-reaching, and collegial opportunity to learn, additional variety can be provided. Finally, with total responsibility for a macroclass, it is much easier for a teacher to provide variety within classes (for example, bring in guest lecturers, plan with another teacher for an in-depth presentation of a particular issue, or develop a field trip). Clearly, the Copernican high school has a distinct advantage.

4

Planning for The Copernican Plan: Changes in The Instructional Program

Teachers or administrators reading *The Copernican Plan* might find it a bit like watching Monday night football: It's fun to watch and debate the wisdom of key plays, but they'd rather not be in the game. Leave it to the pros. Similarly, restructuring schools is thought to be a pleasant subject of discussion. But it's time to do more than talk; it's time for teachers and administrators—our educational professionals—to get into the game. The purpose of this chapter, indeed, of this book, is to convince educators that they can win the restructuring game. Though the changes appear overwhelming, they are manageable.

By discussing how the Copernican Plan will affect a school—both schoolwide and by department—the following sections attempt to help interested schools to plan for a Copernican high school. But one factor cannot be included in these sections: the strengths and weaknesses of each school. Therefore, what follows are guidelines. Each school staff should use the guidelines to develop a process for planning the change in their particular school.

Schoolwide Changes

Scheduling and instructional planning. The most obvious change the Copernican Plan proposes is the schedule. The major impact of scheduling changes will be on how teachers plan for instruction. Presently, high school teachers must plan for five classes, usually including more than one subject within a discipline and sometimes including classes in more than one discipline. Though a teacher's major

emphasis is on preparing for each class, students progress at different rates, depending on their preparation, aptitudes and learning styles, or personal situations.

My experience has been that teachers usually want to individualize; however, with the constraints of several different classes and disciplines and with 100 to 125 students, most concentrate their extra help on those who are falling behind. They simply don't have time to extend help beyond this group, much less to every student in five classes. Indeed, time usually is not available to adequately help all those encountering problems.

The Copernican Plan concentrates most of the teacher's and students' time on one subject and allows for a smaller average class size, ranging from 8 to 20 students and probably averaging 16. The two-subject, trimester approach doubles those numbers but still reduces the number of students the average teacher sees each day by more than 60 percent. The teacher has complete responsibility for a macro-class. Therefore, the success of the Copernican Plan depends on careful instructional planning centered on the progress of each student or small group of students rather than on presentations to whole classes. This is the most significant change—the change on which the feasibility of the rest of the Copernican proposals depend.

Thus the type of preparation required of teachers will change fundamentally. Studies show that, in the range of 20 to 30 students, arbitrarily reducing class size provides no evidence of improvement in learning (Bennett 1987); however, some improvement appears when classes get down to around 15 students. Indeed, a few studies indicate that larger classes provide more effective instruction, which seems to be additional evidence of the relative value of a good teacher (Educational Research Service 1980). The major message of this research is that it won't help much to lower class size if teaching remains geared to whole-class instruction. Secondary teachers generally have concentrated on whole-class preparations with relatively little individualization primarily because that is the only manageable approach under present conditions. The use of large-group instructional techniques with small classes does not get better results. Lowering class sizes will result in no significant improvement unless teachers change the way they teach to take advantage of the opportunity to individualize.

A Copernican teacher's daily planning will be neither easier nor more difficult than at present, but it will be different, for it will focus on individuals and small groups of students. Individualized planning and instruction, which are associated with more effective learning, stress a well-organized curriculum with variety and options so that teachers can continuously keep instruction and assignments at the

frontier of each student's level of understanding. It involves daily interaction with each student. It demands continuous assessment of progress, rapid feedback of results, use of positive reinforcement, and direct and subliminal strategies to transfer the teacher's enthusiasm for his or her subject to students so they realize that what they learn is more important than grades or credits. It directs students' efforts while placing more responsibility on each student. It is adaptable to different learning characteristics or styles of students, and it is able to capitalize on students' different backgrounds and interests.

Organization of curriculum. Today's typical high school curriculum is organized along departmental lines with relatively little interdisciplinary instruction. Courses are offered for a full year, half year, or quarter year. Initially, a school implementing the Copernican Plan will need to concentrate on reorganizing its present curriculum for highly individualized instruction in macroscheduled classes—after it has reviewed and clarified the current scope and sequence and major objectives for each course. As described above, instructional strategies will require most attention at first to keep each student grouped and learning effectively.

The Copernican Plan offers some major opportunities for curricular improvement:

- Interdisciplinary courses can be developed, with two or more teachers working together as a team. Although teams are not necessary to begin, it will be easy to introduce teaming once teachers and students become accustomed to a Copernican schedule.
- A major new part of the curriculum will be the interest/issues seminars, which are discussed below and in the sections of this chapter concerning academic departments.
- Many proposed courses that have never been scheduled because of low enrollments may be presented since there will be more sections. These courses could also be provided through the seminars.
- Community involvement in the seminars will contribute to a more adult atmosphere in the school and directly involve community members and others with the instructional program.

Integrating experiences: interest/issues seminars. A major criticism of American public education is that students do not have an opportunity to come to grips with real issues and that there is a lack of depth

and quality in today's educational programs. Presently, teachers try to provide time to discuss issues, but covering the course material in their disciplines uses most of the time. Activities and clubs are intended to provide some integrating experiences, but with only limited success and small numbers of students. The problem is that the present system does not provide a mechanism for integrating learning but leaves it to chance. Issues are interdisciplinary; they will not be addressed effectively or in a balanced manner in an instructional environment organized by academic disciplines.

The Copernican Plan addresses the question of integrating experiences directly through the interest/issues seminars and indirectly by providing a large block of time for instruction that allows teachers time for in-depth discussion, special classes, or field trips that increase interest in and lend relevance to their subject.

The interest/issues seminars add a new dimension to the school's instructional program. The seminars emphasize presence, participation, interest, and leadership rather than achievement of specific academic objectives. Credits are granted based on the student's achievement of participatory objectives. In fact, a great deal should be learned, and there should be constant references to, as well as opportunities to apply, information gained in regular classes.

These seminars provide high school students with a new experience for which there is virtually no precedent. In addition to the discussions of time allocations and credits, which are discussed in Chapter 2, the following considerations should be incorporated into the interest/issues seminars:

- First, a group of staff, students, and parents should develop the seminar format and curriculum. Then a permanent planning group—again comprised of staff, students, and parents—should be established to develop the seminars. This could be called the Seminar Planning Board. The major task of this board is to review and approve current seminars and suggestions for new topics.

- At the outset, a major curriculum development task will be to prepare a full year of interest/issues seminars. It will be important to access the large volume of materials already prepared and in use by many organizations, industries, and governments in developing these seminars. Obvious examples of sources are public radio and television (PBS), special interest groups (e.g., the Sierra Club, Common Cause), and government agencies (e.g., U.S. Department of Agriculture).

- A regular 10- to 15-minute newscast could be a part of every seminar period. This could be provided through radio or televi-

sion stations and should be concentrated on international, political, economic, or social issues—no weather or sports, or almost none.

- Seminars should be defined very flexibly. The objective is to excite students. Here are some examples of seminars that are intended to show the diversity that should be possible:

  a. Election campaigns issues: local, state, national.

  b. Economic questions: "G.M., Toyota, Productivity, and You," "Should We Sell Wheat to Russia?" "Perestroika, the European Common Market, and You."

  c. Political theory and practice: Are freedom and equality compatible goals in our democracy? Is *glasnost* necessary to the success of *perestroika*? Are the four freedoms necessary conditions to democratic government?

  d. Environmental issues: "Energy and Health: What's the Trade-off?" "Is Man an Endangered Species?" "Pesticides and the Food Supply."

  e. Identifying issues: Participating on teams that prepare materials for future seminars could be a seminar assignment for both teachers and students.

  f. Student enterprises: With more flexible time, students could turn their interests into enterprises like the following:

     An agency for students who want to work. This could be combined with present work/study. They could organize yard work, baby-sitting, and so on.

     Vocational education activities such as construction projects. In some schools, students have even built and sold a house each year, with the money retained in a revolving account.

     An investment club or clubs to help students learn about our economic system. Volunteer advisors could be found. It might be possible to establish student investment teams to compete within the school and, even, with those from other schools.

     A branch of a local bank in the school.

     Coordination of all fund raising for various student groups.

     A day-care center where they could learn, earn, and make money for their school or class.

g. Volunteer community service programs: I-credits could be given for volunteer work by students in hospitals, nursing homes, and the like. The volunteer groups could be a permanent student organization that would provide continuity to volunteerism.

h. Social issues. Virtually any health care and social problem is an excellent subject for seminars, for example, the change in the laws concerning driving under the influence of alcohol, or child abuse and proposed legislation about this problem. What are the causes and costs of homelessness? Can incentives be built into a welfare system? "AIDS: A Medical, Social, and Moral Problem."

i. The arts: Art and music appreciation could be interest seminars. "The Arts in America" could be an issues seminar.

j. Morals and ethics: "Great Religions," "Religions as a Force in History," "Business Ethics: A Conflict in Terms?" and "Cavcat Emptor circa 1989" could be important subjects of both interest and issues seminars.

k. Current issues and crises: The Seminar Planning Board could plan and call for special assemblies to be followed by discussions in all seminars concerning recent events of particular importance or an especially good interest seminar, for example, "The Marines in Lebanon and the War Powers Act," a concert or a visiting author or artist, "Irangate."

Staff development. Planning for and providing high-quality, ongoing staff development and support is important for any school; it is critically important for a Copernican school. Typical high school teachers must prepare for their changed role and rethink their approach to instruction. To those who claim that schools or school districts can rely on written curricula, I say that the only operational definition of curriculum is what happens when a teacher gets in a classroom with a group of students.

Applying what we know about learning, teachers must deal with a manageable amount of information at a time, break the concepts to be considered into manageable chunks of information, and be directly involved in studying their own curriculum. They must have a manageable number of suggestions and approaches to consider, and they should be expected to make a response. They should have opportunities to work with small groups of other teachers and with mentors, for example, more experienced teachers, consultants, or university

professors, who can provide rapid feedback; moreover, they need time to work through ideas, problems, and fears.

And there will be fears, though rarely acknowledged. Fears will be reduced—and a supportive atmosphere developed—as colleagues report their success teaching macroclasses. Fear will decline even more as other schools successfully restructure. Even then, all teachers should have paid time to plan, most likely over one or two summers. It may be the most important professional work they do that year.

I recommend that school districts give a group of teachers an agreed-on fee, authorize some consultant money, ask them to work out their instructional program, and be ready in a year. Trust, empower, enable, and support them. Time, respect, and positive motivation are just as important to teacher and administrator growth as they are to students; taking responsibility for their own education is equally important. The avoidance of the term *inservice* has been deliberate because it seems to conjure up a class or workshop for potential Copernican teachers. It is fine to have a workshop, but teachers should be part of the process for identifying their needs and putting the program in place (Loucks-Horsley et al. 1987).

Both the method of teaching and the organization of the curriculum for teaching are critical, as was shown in Chapter 3. Present curricula may need to be reorganized according to the concepts of the mastery system. Teachers not only have to establish objectives with appropriate scope and sequence, they also have to plan and prepare a variety of teaching techniques and approaches that can be applied in macroclasses. And these options should be thought out and reduced to class plans before the academic year begins so that teachers are free to concentrate on applying these options in different situations during the year.

Material and equipment support. The Copernican Plan establishes conditions that allow teachers to tailor assignments to student progress and learning styles and to work more in small groups and with individual students. The Plan also emphasizes greater student responsibility for their education. It isn't necessary to add to a school's equipment inventory to gain improvements projected in this Plan, but to take the most advantage of teachers' vastly increased control of instruction, teachers and students should have access to new technologies. This means having equipment and reference materials, often including microcomputers, permanently located in classrooms and available at once and at will. Investing in technology is better justified because a Copernican school can use it more efficiently.

The emphasis on integrating experiences via the interest/issues seminars as well as the opportunity to have individual students or groups

of students undertake individual projects and assignments will place much greater demand on school libraries. Libraries need to provide ready access to educational television tapes and films, microfilmed reference material, and appropriate computerized databanks that can be the basis for seminars and student research. A major objective of the Copernican Plan is to develop in students the skills, knowledge, and confidence to learn on their own—to research the information they need. The library and media services will be important for implementing this objective.

Field trips and transportation. High schools increasingly provide field trips, and often students go on tours or exchanges with students from other countries. Sometimes, students even visit neighboring schools of different character from their own (for example, suburban students visiting an urban school) or their state or national capital.

The flexibility to move beyond the walls of the school has always been available philosophically but not practically. The inherent problem in field trips under the present system is simply that a trip for one class removes a student from several other, equally important, classes. Under the Copernican Plan field trips can be easily arranged. For example, a marine biology class can spend a week at a facility like the Woods Hole Oceanographic Institute in Falmouth, Massachusetts; an American history class can visit its state legislature; a French class can spend three weeks near Paris; or an earth science class can visit a national park with virtually no interference with other classes. Indeed, some field-trip activities could become the basis for an interest/issues seminar. The Copernican Plan makes it practical and desirable to increase the number of field trips, so long as they are well planned and have clearly identified instructional objectives.

Guidance. Since the influence of the guidance department is schoolwide, it is included in this section. A fundamental objective of a school should be to treat students as clients rather than wards who owing to a combination of law and custom are under our supervision. High school students are young women and men with specific interests and objectives that their school should help them achieve. As discussed in Chapter 2, the client concept should permeate the thinking of the entire staff, but it will fall to guidance personnel to play a key role in its implementation. All students should know what they are trying to achieve and what they must do to get there, and each should have reasonable expectations of the potential benefits of success. The students' education—as well as the school—should be managed by objectives.

The key to achieving a client relationship is to develop an Individual Learning Plan (ILP) for each student. Each ILP should begin with a postsecondary objective and then establish the levels of mastery in each of the subjects and selected related activities necessary to achieve that objective. In addition, the district's required objectives for both academics and citizenship would be stated. The guidance department would be responsible for developing these ILPs, with assistance from the rest of the staff. Parents, too, must be involved in this planning. Indeed, school boards would have to take a strong policy position on the requirement of parents to accept appropriate responsibility in developing these plans. Reporting would be related to each student's plan.

Each ILP should take a student through graduation. This means a four-year selection of courses for a 9th grade student. But a key element of an ILP is that students could change their objectives at any time based on current interests and their academic progress. I anticipate that students will tend to establish more rigorous goals at first and later will decide on goals more attuned to their actual performance, but it will not always be that way. It will be more difficult to shift to a more demanding goal as a junior or senior. However, some students mature later than others and every effort should be made to allow students to shift to more demanding goals. The guidance department, and indeed the entire school, must be aware that change is desirable and often reflects maturing judgment. Establishing an objective provides a focus and a reality for students; however, it is as important to review that objective as it is to achieve it. Guidance must ensure both for each student.

As in any school, the guidance department will continue to be responsible for transfer students, including assessing credits and levels of mastery for appropriate placement in courses. And it will fall to the guidance department to develop an efficient transcript to convey to colleges and to other high schools the levels of performance of students in each subject. Since the two major determinants of interest to colleges, class rank and SAT scores, will not change, this task should not prove difficult.

The Copernican Plan makes it possible to accommodate highly individualized learning plans. It will allow a student to be on an internship for a six-week period and still complete five regular courses, or to be away for a trimester and complete four regular courses. High school internship programs could be provided with virtually any occupation (architect, engineer, legislator, hospital administrator, carpenter, mason, sales representative, nurse, hospital technician). Internships and independent study could become an important part of

some students' programs. This vastly improved opportunity to tailor a program for a specific student will test the creativity of the staff. But flexibility will improve the quality of the client's ILP. Creating many options should be the key in guidance policy for a Copernican high school.

Range of course offerings. With the persistent decline in high school enrollments and continuing financial limitations, high schools have difficulty offering courses at different levels of ability; they are also limited in the range of course offerings. Teachers who teach five courses a year under the current system will teach six under the Copernican Plan. Thus, it will be possible to offer many more sections with the same staff, which presents a pleasant paradox. With the availability of more sections, students can be grouped more homogeneously, but because of the greater opportunities to individualize instruction, there should be less need to group homogeneously. Scheduling should be easier, and the available sections could be allocated more to expanding the range of offerings and less to offering levels of difficulty in the same course. Further, the interest/issues seminars offer a major expansion in course offerings.

Dual credit. If instruction becomes more effective, the range of performance of a class of students will probably be considerably increased. Although the lower performing students will achieve more, the higher performing students are likely to move ahead even more rapidly, thus expanding rather than reducing the ranges of performance that the school program must accommodate. For several years, some school systems have been making arrangements for high performing students to take college courses and receive credit for high school graduation. This allows these students to retain contact with their peers, remain on academic or athletic teams, and graduate with their peers—and still move ahead academically. However, this practice is still very much the exception rather than the rule. The concept of dual credit should be expanded under the Copernican Plan. If a student needs a course taught at a postsecondary school, or even at another secondary school within commuting distance, the school should attempt to accommodate the student's interests. In larger high schools, college credit courses might be offered at the school if appropriate arrangements can be made with a college.

Transcripts. For many students, and increasingly so in our complex society, the postsecondary goal is college, and high school transcripts are important. Under the Copernican Plan, courses would be re-

ported by credits and titles, as they are now. A clear description of the type of diploma and the requirements for that diploma would have to be part of the transcript; in addition, attached to the transcript should be an assessment of the performance level achieved in each subject along with a description of the mastery learning system that is the basis for the credits. Of course, SATs would still be shown, and the reporting of class rank would not change.

Departmental Changes

Instruction in most American high schools is organized by department. This organization may vary some, but it is generally similar from school to school. The following sections discuss the impact of the Copernican Plan on the instructional departments of a typical high school.

English. In terms of years of study, English is the most required course taught in American high schools. Folklore has it making up two-thirds of the curriculum: "readin', writin', and 'rithmetic." Today's list goes beyond reading and writing in scope and detail. The list might include grammar and language; composition, including style and expression; spelling; vocabulary; speaking and listening skills; study skills; reading skills; understanding and appreciating literature; and understanding and evaluating the media.

English is referred to as a tool subject since it is necessary to the learning of all other disciplines. Indeed, it is difficult to separate language from the content and concepts with which it deals. Literature, both prose and poetry, has beauty that lies in its use for the development of values and creation of interests that may be emotional, religious, cultural, scientific, or all the above. Certainly, English is interdisciplinary.

One way in which a Copernican school can reinforce the interdisciplinary nature of English is to assign each student's English teacher for the entire year—that is, the teachers of the macroclasses in English will follow their students for the entire school year. Students can complete the higher-order English objectives in the context of any other class or in an interest/issues seminar. Dual credit might be achieved for an excellent research paper in a history course, for leadership of a seminar, or for demonstrating skill as a public speaker or leader of a group. An interest seminar could include writing or presenting a paper comparing Laurence Olivier's and Christopher Plummer's interpretations of Hamlet, assuming tapes of both performances could be made available (and they probably could). Literature objec-

tives might be achieved in part through seminars and the I-credits.[4]

There is a tendency to view English by its components and to teach it in a dissected form (diagraming sentences and memorizing spelling lists). These exercises may have a place in the instructional process, but they should not dominate it. The Copernican Plan offers an opportunity to teach English in context but at different levels of difficulty. Reading, writing, speech, and literature, and technical subcomponents of each, can be taught at coordinated levels of difficulty in class, with the seminars available to provide reinforcement.

Mathematics. Mathematics is probably the oldest and most universal of the organized disciplines, dating back perhaps 5,000 years. Like English, it is a tool subject that is applied to more and more fields. The mathematization of nearly every field of inquiry has been expedited by advancements in statistical research techniques and the availability of the computer, which makes immensely complicated and diverse databases manageable. Mathematics is important in three ways: First, mastery of basic mathematics is necessary to manage one's personal finances and to deal in the marketplace. Second, mathematics is increasingly important in becoming an effective employee; mathematics is applied daily in many ways in the trades as well as in the professions. Third, understanding mathematics is extremely important to be an effective citizen and to cope with public affairs in a modern, superindustrialized society.

A high school must teach "consumer mathematics," and a student's math objective should not be limited to a vocational goal. Practical applications of measurements and mathematical concepts should be an important part of the instructional program. The computer should be used to allow students to undertake more complex problems. Ability to understand and interpret typical governmental and economic statistics and to prepare simple statistical presentations should be required instruction for virtually every student. The seminars can provide important opportunities to apply math to current problems.

The effectiveness of mathematics instruction in the United States has been seriously challenged by the results of tests given in international competition. And mathematics is one area in which comparative performance of students in different countries can be made with little risk of interference due to cultural or language differences. American students have not performed as well in mathematics as have many of their counterparts in other countries (National Commission on Excellence in Education 1983; Lapointe, Mead and Phillips 1989). Some of this disparity is blunted since approximately 75 percent of young people in the United States complete high school,

whereas smaller percentages are in school at this age in other countries. But the criticism appears to be valid when American students are compared with the Japanese, 90 percent of whom complete their secondary school educations (Dorfman 1987). The National Assessment of Educational Progress reported a sharp drop during the 1970s in the ability of 17-year-old students to solve more complex problems, although there was an upturn between 1982 and 1986 (Dossey et al. 1988). And the Educational Testing Service reported in 1989 that U.S. students turned in the worst combined scores in an international comparison of 13-year-olds (Lapointe, Mead and Phillips 1989). The National Academy of Science also severely criticized U.S. math education in a 1984 report (Panel on Secondary School Education for the Changing Workplace 1984).

Research on mathematics has revealed that attitudes toward mathematics as a school subject peak in early adolescence and decline during high school. Moreover, males seem more confident with mathematics, and positive attitudes toward mathematics and the perceived usefulness of mathematics are highly correlated with mathematics course participation. Thus, the development of interest and confidence and infusions of practical, useful applications seem to be associated with success in mathematics. Interesting also is that ability in mathematics seems to peak early. The American Association for the Advancement of Science (1989), the Task Force on Education for Economic Growth (1983), and the National Assessment of Educational Progress (Brown et al. 1988) criticize the quality of mathematics teaching as abstract and emphasizing rote use of procedures.

The Copernican Plan's proposed ILP for every student requires that they identify the levels of mathematical ability that are appropriate for their postsecondary objectives and then reports their progress against the level of proficiency needed. The focus on individual students should encourage all students to master more mathematics than is the case today.

Science. The report by the National Science Board of the National Science Foundation titled *Today's Problems, Tomorrow's Crisis* (1982) notes that "we appear to be raising a generation of Americans, many of whom lack the understanding and the skills necessary to participate fully in the technological world in which they live and work" (p.1). In sum, the report establishes three basic objectives to be achieved through our mathematics and science programs:

1. To develop and broaden the pool of students who are well prepared and highly motivated for careers in mathematics, science, and engineering.

2. To widen the range of high-quality educational offerings in mathematics, science, and technology at all grade levels so that more students would be prepared for, and thus have, greater options to choose among technically oriented careers and professions.

3. To increase the general mathematics, science, and technology literacy of all citizens for life, work, and full participation in the society of the future.

The report goes on to note evidence that the United States is not achieving these objectives, particularly in areas of problem solving and the applications of mathematics. It reports on the concern of both industrial leaders and military commanders concerning the shortage of trained technicians. Even the professions of law, journalism, and business management face a growing demand for men and women with backgrounds in mathematics, science, and technology.

Who can question the need for scientific literacy for the average citizen when one constantly encounters the claims and counterclaims of various groups on issues such as nuclear power, environmental protection, or the delivery of health services? The report notes that many of the upper-level high school courses are too abstract and theoretical for most students. It further states that few of these courses are of much value to students planning careers outside science and engineering. An interesting finding is that although many students do not like school science, many do like the science and technology they see on television, at technology museums, planetariums, nature centers, and national parks; the report strongly suggests that there is a need to make school science programs more appealing, for example through "hands-on" activities that build on students' understandings of science concepts and the world around them.

The Copernican Plan's macroclasses allow teachers and students time to probe science questions in depth, to undertake virtually any experiment, and to utilize equipment fully, which is very difficult to do in a 45- to 50-minute period. Moreover, field trips to local universities, science museums, high-tech facilities, or field or shore for botany or marine biology are feasible and can be conducted without seriously interrupting other classes. A great deal of good instructional material is available on videotapes, which, if made available to teachers and students, could enhance instruction. Finally, the interest/issues seminar is an excellent vehicle for developing greater citizen awareness of the impact of science and technology and of the political, ethical, and religious issues that relate to these questions. In this regard, presentations could be interdisciplinary and involve participation of knowledgeable citizens.

Social studies. The National Assessment of Educational Progress (Finn and Ravitch 1987) indicates an alarming lack of basic knowledge on the history of this country and its political structure. The critical message in each of our presidential elections is not who won the election but the steady decline in the number of citizens who participated in the selection process for the most powerful and important position in the nation, and perhaps the world. Many of our young people could not become U.S. citizens if they had to pass the naturalization test required of immigrants.[5] Perhaps immigrants are more inspired than the average American—or at least the average American teenager—or perhaps we need to provide more inspiration.

At the risk of oversimplification, social studies teachers seem to fall into two groups. Most seem to want a wide range of offerings that emphasize the analysis of complex and interrelated issues involving various political decisions and historical trends. A smaller group prefer providing a firm and common base of information on the major political and historical facts that will help young people understand how they got to this particular time and place. Both groups are correct. The problem is that the time allowed and the structure of the school day requires that a choice be made. Regardless of the choice, the loss is serious. Although reading, mathematics, and science seem to head the current list of national educational deficiencies, probably the failure to excite our students about their country and their responsibilities as citizens is the greatest failing of the American public school system.

The Copernican Plan offers important opportunities to improve on this performance. Macroclasses allow in-depth discussion and maximum use of media, field trips, and community resources in instructing students. The social studies department should take the lead in developing the interest/issues seminars. Most of these seminars may involve understandings coming from several disciplines, but many of the fundamental issues would be political, cultural, religious, and ethical and, let us hope, might serve to make young native-born citizens as eager to be a part of this country as those who seek us out from other lands.

Occupational education—industrial arts. The Copernican Plan adapts easily to industrial arts. Vocational education has a history of using three- to four-hour periods and combining related classroom work with shop work. The traditional short period has always been a problem for industrial arts, where time is lost in setting up and cleaning up. The Copernican Plan also offers a partial solution to students who want more vocational training than is offered in their high

school but who want to remain in or part of the school. In those areas where vocational technical schools and comprehensive high schools are located near each other and serve the same student pool, the macroschedule will make it much easier to schedule a student in a vocational school program for part of the day or year while retaining membership in the community high school. Alternatively, if no vocational high school is available and, because of size and costs, a school offers only industrial arts programs, it should be possible to assign students to work with an industrial arts teacher on a highly individualized basis to attain vocational level skills under a Copernican schedule. Videodiscs and VCRs can enhance instruction. Teachers can certify that the needed level of mastery has been attained for the Occupational or the Honors Occupational Diploma. Once a student has met the required mastery in other areas, such as mathematics and English, greater concentration can be allowed on independent study in technical and vocational areas.

Industrial arts can also be effectively included in the interest seminars: home repair, carpentry, cabinet work, automobile maintenance and repair, furniture refinishing, and popular science and technology can be the basis for interest seminars.

Occupational education—home economics. Home economics programs on the high school level have been declining for several years. The courses attract a small proportion of students, and declining enrollment has resulted in many home economics courses being dropped in the competition with other classes.

It appears that home economics can be organized much more effectively under the Copernican Plan since the course emphasizes lab work and practical problem solving. Further, with 20 percent more sections, it will be easier to solve scheduling conflicts to enroll in home economics courses. Provided space is available, the home economics program could revolve around a day-care center, which could be self-supporting.

It also appears that the interest/issues seminars provide an opportunity for home economics and early childhood education. There is a growing concern about the evidence of dysfunctional families and child neglect, with child abuse the extreme form of this problem. Seminars on these topics could be developed in conjunction with health education.

Occupational education—business education. The Copernican Plan will have a major influence on a high school's business department and offers an opportunity to try a different and potentially productive

approach. Mastery learning lends itself especially well to business education. The knowledge and skills needed for effective office work can be precisely defined. As students demonstrate the necessary skills and understandings, they can receive the credits and move ahead. The increasing use of electronics in the workplace is changing radically the jobs that young businesspeople may aspire to. Business education courses need to define a series of objectives that, if met, would provide well-educated, completely trained office personnel.

In addition, many students who are planning to go on to college need the skills taught by the business department. Virtually every student needs keyboarding skills, not so much for yesterday's typewriter as for today's word processor. Perhaps college-bound students ought to have note-taking skills as well. Keyboarding and note-taking skills can be defined and measured and offered in a single macroclass.

Art. Art is another discipline that will benefit from macroscheduling. Students can use the art classrooms like a studio, with adequate time to critique one anothers' work, an important part of an art program. More courses can be offered with the same staff, so more students will have the opportunity to fit art into their schedules. Field trips will also be easier to arrange. In addition, it might be possible to introduce art appreciation as part of the interest/issues seminars.

Music. Though many of the observations made about art apply equally to music, there is one major difference: It is difficult to rehearse a chorus, band, or orchestra for four hours; however, a two-hour class would be productive. More to the point, music is part of our school and community life and should be available throughout the year. Band and chorus should be offered as a class scheduled during some of the seminar or PHS periods. This arrangement eliminates scheduling conflicts and allows rehearsals throughout the year. As shown in Chapter 2, Table 1, it reduces music student participation in seminars, but music appreciation programs can be interest seminars.

A difficulty will be scheduling music teachers for a full day if their classes don't begin until late morning. However, the number of evening hours for concerts and dramatics must be considered in determining assignments for music teachers. The role of the music teacher may be redefined to exclude some of the traditional classes and to include the late afternoon and evening demands of the music program.

Foreign languages. Foreign language presents an interesting problem under the Copernican Plan. Language experts seem to have two con-

flicting positions (American Educational Research Association 1969). The first is that total immersion in a language is the best way to learn a foreign language quickly and well. This position is supported by the experience of programs such as the Berlitz schools and the Armed Forces language programs. Canada has had good reports from its immersion programs (Benderson 1986). The other position is that language instruction should be taught incrementally, but daily, with prepared materials that require constant review and reinforcement. The former favors a macroclass; the latter the traditional length period over a full year. I recommend an immersion-oriented approach under the Copernican Plan.

In the macroclass, language labs and other technology can be incorporated into instruction, and instruction can utilize speaking, reading, writing, and cultural/historic activities. Most subjects receive reinforcement in other classes. But foreign language students get virtually no incidental reinforcement. Therefore, in the intervals between foreign language macroclasses, students should enroll in interest/issues seminars that deal with the history and current events of a country that speaks the language they are studying. Also, language clubs could meet in the PHS periods, perhaps reviewing foreign newspapers, seeing foreign films, and discussing the events in France, Germany, Russia, or Spanish-speaking countries.

Physical education and athletics. Most states require physical education each year through the 10th grade, usually every other day; some require it through grade 12. The objectives for physical education concern acquiring skills and knowledge and developing attitudes through human movement. The program should include assessment of fitness levels, activities to strengthen personal weaknesses, and the development of lifetime sports.

The Copernican Plan schedules physical education in a nontraditional way. For example, students who participate on an athletic team receive credit for physical education. Physical education classes are offered at the same time as the seminar and PHS periods so that students can select modules of physical education; each module consists of 15 70-minute sessions. Three modules during a school year provide about 75 percent of the time students now spend in physical education classes. As in other classes, the longer period will be more efficient. A waiver from the state department of education may be necessary for this type of schedule.

Following a system of mastering specific objectives, the physical education department will need to identify objectives for physical fitness, knowledge, and performance. Credits will be earned based on

performance, as they are in any other subject. Each student's ILP will also establish objectives for physical education. Minimum fitness objectives could be mastered as part of a team. Lifetime sports should be a major objective. Meeting higher-level objectives could result in honors credit. Students who fail to meet minimum physical fitness objectives or who require extra help could be scheduled into more classes. Voluntary after-school fitness programs could be approved. The bottom line is to meet the students' ILP objectives for physical fitness.

A major change—and one that may generate controversy—is in the relationship between physical education and athletics. Any student participating in athletics should not be assigned a physical education class during the season. This plan would require a no-cut policy for athletic teams. The coaching staff may have to expand to accommodate the larger number of participants expected, and it will require some imaginative scheduling to give each student some competitive experience. Formalized intramurals with a schedule, equipment, coaching, and awards might be one solution. The objective is to greatly increase the number of students who participate in athletics.

With physical education scheduled only two times each day, staffing of classes will present a problem. The emphasis on participation in sports with a no-cut policy will also require more afternoon coaching. Regular teacher assignments are for a macroclass of about four hours, a 70-minute seminar, and a 70-minute PHS period. There are two alternatives for covering physical education. Some teachers could teach physical education instead of a seminar assignment, or some physical education teachers could arrive midday and carry a late afternoon intramural or coaching assignment. In effect, the full-time assignment of a physical education teacher would have to be redefined. The result probably would be a larger number of teachers involved part-time in physical education. The staffing of physical education would require planning and perhaps some assistance in staff development.

5 Staged Implementation

The major problem confronting a school community that is seriously considering the implementation of the Copernican Plan is the degree of change it requires. However, tackling complex changes may have its rewards, once enacted. Several studies have shown that the more complex the change, the greater the chance of successful improvement once the change is implemented (Crandall, Eiseman and Louis 1986). Administrators, whether in private or public enterprise, are well aware that organizations faced with change can develop formidable rejection mechanisms. Successful change requires, among other things, careful, broadly participatory planning; clearly defined changes; training; and administrative support (Fullan 1982, Crandall and Associates 1982).

Any high school undertaking the type of restructuring proposed in this paper must be prepared for substantial teacher and parent rejection. It may take two, three, or more years to plan this level of change, and most of that time will be needed for teachers, parents, and students to conceptualize the change and accept it as something they can do. During this period, it is important to remember that leadership is not followership. It may be lonely at first. The initial response of teachers, and more particularly, parents and students, is that the long class will be a long lecture. They need to realize that there are more effective ways for students to learn that require a coachable relationship between teachers and students.

How would a high school begin? Remember that the Copernican factor of this Plan is the change in the schedule. Once that has been accepted, it is possible to implement the other changes. Make that

change first, but retain the familiar curriculum and current grading standards. Initiate the seminars. Acknowledge that it is unlikely that a school can change in one year, particularly before many high schools have done so and shown the way for others.

A preliminary analysis of how the Copernican Plan will affect school programs is presented in Chapter 4. Some of the salient features of that chapter should be carefully reviewed in planning to implement the Copernican Plan, particularly the following:

- Planning and preparing for new ways of instruction is critical. There would not have to be any change in the curriculum to begin. The courses, the course objectives, and the current evaluation standards need not change. But the way teachers teach the classes, the way students are deployed for instruction, and all the classroom activities require major change. Teachers need time to restructure their lesson plans. A major part of this work should be done in summer months when teachers do not have the pressures of teaching and can concentrate on planning. And they should work together with other teachers and appropriate consultants so that they can share ideas and critique proposals. Let's begin to bridge the gap between high schools and the colleges and universities, between research and practice. The Copernican high school does not yet exist, but many in academia and educational service organizations know how to individualize instruction. They can help teachers take advantage of the opportunities for closer working relations with students and the teacher's increased control of the instructional environment. And those knowledgeable about elementary and special needs instruction can be of help since they often teach their students for several hours each day.
- A complete year of interest/issues seminars needs to be prepared and ready for use. This involves creating a permanent planning group of staff, students, and parents on a Seminar Planning Board. The Seminar Planning Board's major task is to review and approve proposed seminars, oversee their development, and respond to seminar evaluations. The actual process of developing individual seminars and associated curriculum will involve large numbers of staff, students, and parents; further, the Board might call on persons expert in an area but not associated with the school. It will also require a coordinator of unusual intellectual breadth and instructional competence. The Seminar Planning Board needs a spark plug.

- To provide teachers with the maximum ability to individualize instruction requires maximum material and equipment support (computers, VCRs, videodiscs, and the like). Though technology can be useful to the traditional high school, the teacher's control of the instructional environment in a Copernican high school will allow technology to be used even more effectively. Although technology can be better used in a Copernican high school, implementation should not await new equipment. The teacher-student relationship is the key to improving instruction, and that relationship can be improved significantly with or without technical equipment.

- The Copernican Plan will create an instructional environment that supports mastery learning. But mastery learning need not be part of the program at the beginning. It will be much easier for teachers and students to develop and adapt to a mastery/credit system if it is developed under a structure that accommodates its implementation.

Every school has some trail-blazer teachers, teachers willing to consider change (Rogers 1983). And every school has some teachers who fear even small changes. Parents and students fall into these categories as well. Work with those students, parents, and staff who volunteer or show an interest. Take your time; plan well; let everyone know what's being planned so that more people, including the critics, are a part of the process.

Most important, plan your evaluation at the same time you plan your program, and get help from a qualified, objective outside evaluator. Then try a pilot program. The first year of any new program is seldom the best, but the results should be positive. Then use the results of your evaluations to refine and improve the new program.

Finally, begin to develop other aspects of the Copernican Plan—the mastery and credit systems and steps to dejuvenilize the high school. Most important, provide *continuing* opportunities for teachers to develop a range of instructional approaches so they can effectively take advantage of their increased control over the instructional process and the new, more personal, coaching relationships with their students.

Summary and a Caveat

Since this proposal has not yet been fully implemented, much is still to be learned. Moreover, many other concepts will need to be considered that have not yet surfaced. One suggestion, which has been offered a number of times, is that the Copernican Plan is ideal for team teaching. Supporting this suggestion is the Carnegie report, *A Nation Prepared: Teachers for the 21st Century* (Task Force on Teaching as a Profession 1986), which states that restructuring would enable schools to make more efficient use of our limited supply of teaching professionals. It appears that a Copernican high school would be greatly enhanced by a Carnegie team, and conversely, that a Carnegie team would strengthen a Copernican high school. Once again, the traditional high school presents problems because it is oriented to departments of individual teachers rather than to teams.

Now for the caveat. The basic question for most educators will be, "Do we really have to change?" *No* individual teacher or school *has to* change, but there is no question that this nation's high schools *are going to be changed*. As major national reports on education have clearly stated, the nation faces very serious problems if it cannot improve the capability of its citizenry and the quality of its work force. Will the public schools as they are now constituted make the changes necessary to achieve these goals? Will educators provide the leadership to meet the nation's demands? Or will others make the changes and create new structures to replace or drastically modify our schools? The stakes are high. As President Kennedy once said: "If not us, who? If not now, when?" The ball is in the educators' court.

Endnotes

1. The 16th Annual Gallup Poll on public education found that only 41 percent of our citizens would support tax increases for public schools (Educational Research Service 1984). The 1988 Gallup Poll found 64 percent of our citizens would increase taxes for public schools (Gallup and Elam 1988).

2. During my tenure as superintendent of the Los Alamos, New Mexico, Schools, 1969–1972, pilot nonremedial summer courses were offered in English, math, biology, chemistry, industrial arts, and art. Courses met four hours a day for six weeks, or about 25 percent less time than during the regular year. Student performance was fully comparable to that achieved during the regular school year.

3. The Effective Schools Research is one of several bodies of research concerned with improving schools. Another is the School Improvement Research perhaps best summarized by Crandall (Crandall and Loucks 1982) and Huberman and Miles (1984). An excellent comparison of the two schools of research can be found in Clark, Lotto, and Astuto, "Effective Schools and School Improvement: A Comparative Analysis of Two Lines of Inquiry" (1984).

4. Although keeping abreast of the English activities of students not currently assigned to their macroclass will not involve the intense individual planning of the macroclass, it does mean additional re-

sponsibility and work. If a school chooses to assign each student an English teacher for an entire year, it will need to offset the increased assignment by reducing the teaching loads of English teachers in another area or areas. An English aide or tutor could be most useful in this work.

5. A few years ago, CBS asked selected high schools across the nation to administer a simple, 20-question test to all seniors. Masconomet Regional High School accepted the invitation and found, for example, that more than a third of our seniors could not name the three branches of government or the two houses of Congress. Masconomet students generally average around the 70th percentile on nationally standardized tests, and about 80 percent go on to college.

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Appendix

Analysis of the Use of School Time Each Day and Comparison with a Traditional Schedule

The Copernican schedule options presented in Figure 1, Chapter 2, complete the school day at 2:39. The high school schedule used for the comparison that follows provides an extra-help period that ends at 3:10, four afternoons per week.

A. **Arrival, Departure, and Passing Time:**

Traditional Schedule: 45 minutes.

Copernican Schedule: (A) 24 min.; (B) 30 min.

Difference: (A)–21 min.; (B)–15 min.

B. **Estimated Typical Student Instructional Time**

Traditional Schedule: Those taking five and a half courses (including required physical education every other day) average about 253 minutes. The average student takes six courses, or 276 minutes. Those taking seven subjects could spend 322 minutes in class.

Copernican Schedule: The macroclass plus the interest/issues seminar equals 296 minutes for Schedule A and 290 minutes for Schedule B.

Difference: Only students who now take seven courses would have less instructional time under the Copernican schedules (approximately 1/2 hour less). For students now taking six courses, Schedule A of the Copernican Plan offers 20 more minutes, Schedule B, 14 minutes.

C. **Home Room:**

Traditional Schedule: 8 minute periods.

Copernican Schedule: Estimated 5 minutes as part of PHS Period.

Difference: –3 minutes.

D. **Lunch:**

Traditional Schedule: 35 minutes, including passing.

Copernican Schedule: 41 minutes, including passing.

Difference: +6 minutes.

E. **Allocated Extra Help:**

Traditional Schedule: Average 40 min. per day. (45 minutes on 4 days = 180; 20 minutes on 1 day = 20. Total = 200/week.)

Copernican Schedule: 70 minutes/day.

Difference: +30 minutes/day.

F. **Actual Extra Help/Study Hall Time:**

Traditional Schedule: Extra help is optional but available, four days/week. Students spend one period (46 min.) or two periods (92 min.) in supervised study halls. Study halls range from about 40 to 100 students.

Copernican Schedule: All students report back to the teacher(s) of their macroclass(es) for 70 min. of study or extra help. Students on the B schedule would report to the two teachers on alternate days.

Difference: The net result is less study hall time but more extra help time. Extra help time is spent with the major class(es), with professional help readily available in a small class. Every student will have well-planned study time. Students may be released by teachers to go to the second teacher under schedule B, according

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to their need for help. They could also follow up on an interest/issues seminar, possibly researching information for the next session. The macroclasses have priority and time is controlled by those teachers.

G. **Teacher/Student Time**

Traditional Schedule: 284 minutes: classes 236 minutes; extra help 40 minutes; home room 8 minutes.

Copernican Schedule: 360–366 minutes: macroclass(es) + seminar + PHS.

Difference: +76–82 minutes.

H. **Administrative Assignments (Study Hall, Hall Duty, etc.)**

Traditional Schedule: 46 min./day (230 min./week)

Copernican Schedule: None; without study halls and much less movement of students, these duties will be covered by aides and monitors.

Difference: –46 minutes/day.

I. **Preparation Period**

Traditional Schedule: 46 min./day (230 min./week). Five classes to plan, plus adjustment to about 120 students.

Copernican Schedule: 70 minutes PHS per day (less 5–6 minutes for homeroom duties).

Difference: Instructional planning is to concentrate on individual student progress in a single class or two. Planning can involve students during this period. "Extra help" is virtually the same as planning. Only one or two courses, 30 to 40 students, to plan for.

J. **Teacher Work Day**

Traditional Schedule: Monday–Thursday 7:40 a.m.–3:10 p.m.
Friday 7:40 a.m.–2:45 p.m.

Copernican Schedule: Monday–Friday 7:40 a.m.–2:39 p.m.

Difference: Monday to Thursday, –31 min.; Friday, –6 min.

K. **Administrative Meetings**

Traditional Schedule: 135 minutes/month.

Copernican Schedule: 135 minutes/month.

Difference: No change.

L. **Corridor Duty**

Traditional Schedule: Thirty periods (46 min.) per year. Eight class changes per day to cover = 1380 minutes per year. Some corridor duty is covered by aides.

Copernican Schedule: Covered by aides. No teachers are assigned.

Difference: –1380 minutes/year. With 100% assignment of students to macroclasses and greatly improved student control, this duty should be covered satisfactorily by aides.

M. **Library**

Traditional Schedule: Students sign up in lieu of study hall. Study hall teachers receive list from library to check attendance.

Copernican Schedule: Released by teacher to library. Release could be from the macroclass or PHS period. Release could be justified to prepare for interest/issues seminar as well as macroclass.

Difference: No basic changes, but closer monitoring because teachers of macroclasses know their students and their academic progress. They can also know students' seminar assignments and can control student time to prepare for seminar.

N. **Activities and Sports**

Traditional Schedule: Begin after extra help at 3:10 p.m. Students may study between the end of the last period and beginning of sports activities, or they may be in a quiet area of cafeteria. Locker rooms are opened at 2:45 p.m. for students to dress.

Copernican Schedule: All activities and sports begin at 2:45 p.m. and end no later than 4:30 p.m. to allow a half hour to get ready for the bus.

Difference: Late sports and activities would operate as they do now, but without the wait time after extra help.

O. **Busing**

Traditional Schedule: One late bus at 3:25 p.m. Transportation for evening practices is responsibility of parents.

Copernican Schedule: The same.

Difference: No change.

High school educators serious about preparing students to prosper in the economic and political climate of the 21st century should read The Copernican Plan —then set about implementing it. This volume is all that is needed to get started. It describes a new way to structure the secondary school, provides class schedules, compares the old way with the new, discusses the impact department by department, and generally leads the way through uncharted territory.

But the territory is not completely uncharted. The author's own school district is piloting a version of this plan in the 1989-1990 school year. As we go to press, the ground work has been laid, students and parents have signed on, a team of teachers has prepared new instructional approaches and a year's worth of interest/issues seminars, and an evaluation team is poised to observe and report the results.

Dr. Carroll would like to hear from others who are willing to give his groundbreaking plan a try. We encourage any readers who are interested in restructuring their schools along the lines of the Copernican Plan to contact Dr. Carroll or The Regional Laboratory to inquire about the Copernican Group.

About the author. . .

Dr. Joseph M. Carroll's record is one of exceptional depth and breadth. He has taught and administered from Montana to Massachusetts, where he is currently superintendent of the Masconomet Regional School District. He has been superintendent of the Los Alamos (NM) Public Schools an was the first appointed superintendent of the Palm Beach County (FL) schools, where he successfully dealt with court ordered intergration and initiated minimum competency testing—a program that had national impact. In the 1960s he served as an assistant superintendent and later associate superintendent of the District of Columbia Public Schools, where his responsibilities included research, budget, and representing the schools before congressional committees. Earlier, he spent several years as a management consultant with Booz, Allen and Hamilton.

His Copernican Plan draws conceptually and philosophically from this range of experience, but it was his observation of the success of awide range of students when they studied one or two subjects at a time that provided the key to restructuring high schools. When Copernicus showed the sun to be the center of the universe, the motion of the planets made sense. Similarly, Dr. Carroll's proposal to change the schedule allows high school teachers to use knowledge about learning to make classroom sense. In this proposal, Dr. Carroll has proved himself an educational pioneer.